



No vulgar Eye enjoys a fond Delight  
 In Nature's Beauty and Productions bright;  
 This nursing Mother, is of Second Cause  
 Of Plenty, Life, and uncontrolling Laws;  
 When Art doth court her, She unveils her Face,  
 And shews her Charms to her adopted Race.

*Walden's Sculpt*

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*Hubert's Sculp*

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THE  
LABORATORY,  
OR  
SCHOOL of ARTS:

In which

Are faithfully exhibited and fully explain'd,

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|--|--|
| <p>I. A Variety of curious and valuable Experiments in Refining, Calcining, Melting, Assaying, Casting, Allaying, and Toughening of Gold: With several other Curiosities relating to Gold and Silver.</p> <p>II. Choice Secrets for Jewellers in the Management of Gold in Enameling, and the Preparation of Enamel Colours, with the Art of copying Precious Stones; of preparing Colours for Doublets; of colouring Foyles for Jewels, together with other rare Secrets.</p> <p>III. Several uncommon Experiments for Casting in Silver, Copper, Brass, Tin, Steel, and other Metals; likewise in Wax, Plaster of Paris,</p> | <p>Wood, Horn, &amp;c. With the Management of the respective Moulds.</p> <p>IV. The Art of making Glass: Exhibiting withal the Art of Painting and making Impressions upon Glass: and of laying thereon Gold or Silver; together with the Method of preparing the Colours for Pottery-work, or Delft-ware.</p> <p>V. A Collection of very valuable Secrets for the Use of Cutlers, Pewterers, Brasiers, Joiners, Turners, Japanners, Bookbinders, Distillers, Lapidaries, Limners, &amp;c.</p> <p>VI. A Dissertation on the Nature and Growth of Saltpetre: Also, several other choice and uncommon Experiments.</p> |
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The SECOND EDITION.

Illustrated with COPPER-PLATES.

To which is added

An APPENDIX:

TEACHING

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|--|---|
| <p>I. The Art and Management of Dying Silks, Worsted, Cottons, &amp;c. in various Colours.</p> | <p>II. The Art of preparing Rockets, Crackers, Fire globes, Stars, Sparks, &amp;c. for Recreative Fire works.</p> |
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Translated from the HIGH DUTCH.

L O N D O N :

Printed for J. HODGES, at the Looking glass on London Bridge; J. JAMES, at Horace's Head under the Royal Exchange; and T. COOPER, at the Globe in Pater-noster Row.

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JAMES THEOBALD, *Esq.*  
F. R. S.

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Dedication fill'd with Flattery  
and Compliments, would, I  
know, be as unacceptable and  
displeasing for you to read, as it would  
be improper and disagreeable for me to  
write.

YOUR Affability, Candour, Openess  
of Heart, and the many Civilities you  
have for several Years past, condescend-  
ed to honour me with on the one Hand;  
and the Delight and Pleasure you take  
in the Search and Knowledge of the  
various Productions and Curiosities of

A 2

Art



## DEDICATION.

Art and Nature, on the other Hand, are, I hope, sufficient to excuse the Freedom I take in offering and inscribing these my mean Endeavours to your Patronage and Protection; and in laying hold of this Opportunity to assure you of my Gratitude, and of the Value and Esteem I have, and will always entertain for your Person, Merit and Friendship.

BE pleased, Sir, to accept of this with the sincere Wishes for your long Life and Prosperity, from,

S I R,

Y O U R *most obedient*

*and most humble*

*Servant,*

G. SMITH.

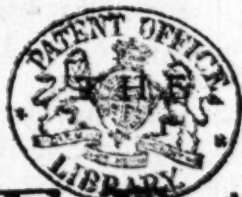
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# P R E F A C E.



NATURE, the Mother of all visible Beings; or, to speak more Christian-like, the Wisdom and Power of God has shewn itself throughout the Universe, in the most admirable and surprising Productions. The Wonders and innumerable Curiosities of our particular System ravish the Eyes of every Beholder, who is thereby prompted to acknowledge and adore the Supreme Being, and first intelligent Cause of so glorious a Frame.

BUT the Manifestation of God's Perfections, was not the only Design of such a Profuseness and Variety of Wonders; it was also design'd for the present Use and Benefit of Mankind. In them we find a Plenty of every thing to supply our Wants, and all Manner of Helps to bring to Perfection the most useful Arts. For though Nature has hid the best, and even the richest Part of her Productions, either in the Deep, or in the Bowels of the Earth; yet is she willing and ready to lay her Treasures open to our diligent Enquiries,

to

## *The P R E F A C E.*

to our Contemplation and Use. The more a Man applies himself to such Researches, the better he answers the End of his Creation: But the less he is indued with that Spirit of Enquiry, the nearer he resembles the Brutes, who enjoy the present Objects, without reflecting on their Beauty, Variety and Usefulness; without minding any thing else but what makes an actual Impression upon their Senses. Such are the People who tread under-foot Arts and Ingenuity, and despise those who apply to Mechanicks, and do their Endeavours to be as useful in that Respect to their Fellow Creatures, as in them lies.

I DON'T doubt but there will be many of that Kind (for of such the World abounds) who will set their Wits at work to find fault with this Performance, either as to the intrinsic Merit of it, the Truth of some Experiments, or the Translator's Stile. But to be beforehand with those Gentlemen, and to save them some Trouble, I freely own myself to be a Foreigner, that has had no great Share of School, much less of University Learning. Nevertheless, I can say without Pride, that I am not destitute of Common Sense and Reading.

I HAVE endeavour'd to translate this Work in as plain, easy and intelligible a Manner as I am Master of; and if there is any Fault, in Point of Grammar or Orthography, I hope Gentlemen of good Sense and good Nature will easily excuse such Trifles, in Consideration of the Goodness of the Work itself. It was not design'd for profess'd Scholars, but for People of Ingenuity and Lovers of Arts.

As to the Truth of the Experiments mentioned in it, I must own, that had my Fortune answer'd my Inclination, I would have carefully try'd them all beforehand. But I leave that to those Gentlemen whose Ingenuity and Purse may go together, to satisfy their Curiosity. I have however try'd some of them, and  
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## *The P R E F A C E.*

they have answered my Expectation, which gives me room to believe that the rest are as true. Besides, I have consulted about it People whose Province it was to be better acquainted with those Particulars; Or, when I could not have such an Opportunity, I have weigh'd them the best I was able, and duly examined their Probability, and the Credit of the Authors thereof: So I dare say, that most (if not all) of those Experiments will stand the Test.

WHILE this Book was in the Press, I have had some Hints given me, that the Publication thereof would give Offence to those Tradesmen or Artificers, whose Mysteries in their respective Professions would be by that means lay'd open to every Body. But as this Argument seem'd to me to be of little Weight, I did not think proper to desist from my Undertaking. Those that are in a good Way of Business, will hardly neglect it or leave it off, in Hopes of making a better Fortune by trying the Experiments mentioned in this Work: And those that get only their Livelihood by their Trade, will find so many Difficulties and Obstructions in such Trials, that they will never be able to go thro' them. But supposing some ingenious Person should by following these Experiments, better his Fortune, and distinguish himself in his Profession (as no doubt it may happen so) where should be the Harm? Must a Man for fear of displeasing a few private Persons, hide Things whose Knowledge not only would prove entertaining but also advantageous to the Publick, and hinder Thousands of People of their Satisfaction in curious Inquiries.

My Aim, in the Publication of this Book, is not to hurt Any Body or any Set of Men in their Professions; God forbid! But it is (to speak ingenuously) first to get Money in an honest Way, which is no doubt the main View of most Authors, though they dare not own it publicly, as I do here; and secondly to oblige the World, especially the Curious who are  
Lovers



## *The P R E F A C E.*

Lovers of Art and Ingenuity, and take a Pleasure in trying Experiments of one Sort or other; Amusements much more delightful and satisfactory to some Gentlemen than Gaming, Hunting, or Reading of Novels, Ballads, and such like. The Artists and Crafts-Men will also, I hope, find it a very useful Performance. They will perhaps make some new and advantageous Discoveries in it, relating to their Trade, which they never knew before. The Selfishness and Ill-nature of some Masters is such, that they will keep their Apprentices ignorant of the most essential Parts of their Business; employ them during seven Years on particular Branches, and conceal from them what they themselves do in a private Room. It concerns those who have labour'd, or do labour under such an unjust or ungenerous Proceeding, to strive to be better inform'd in all the Branches of their Trade: And to many of such this Book, I venture to affirm, will not be a needless Purchase, if they peruse it with Attention, and will try the Experiments, as far as it lies in their Power.

I HOPE these my Endeavours will meet with a favourable Reception from the Publick, as they are the Fruits of a good Intention, presented to the Curious with Sincerity.



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PART I.

A Variety of Curious and Valuable Experiments in *Refining, Calcining, Melting, Assaying, Casting, Alloying* and *Toughening* of GOLD; with several other Curiosities relating to GOLD and SILVER.



**A**S Gold, of all other Metals is the most noble and most valuable, it is justly distinguish'd from all the rest by the Name of the *King of Metals*. *Europe*, as well as the other Parts of the World, affords several Gold Mines; but *Peru* in the *Spanish West-Indies* particularly abounds in them; and as they contain the richest Oar, almost every Nation endeavours to be furnish'd and supply'd therewith.

OF all Metals, Gold is the most solid: It consists of Particles so fine and closely interwoven, that it is a difficult Matter to separate them from one another: It will resist the Fire, and not suffer any Diminution by the Heat thereof, though never so fierce and violent. It is not subject to rust, but retains its natural Colour. Its Weight is ten times heavier than Earth, and a Piece of Gold contains seven times the Matter what a Piece of

Glass doth of the same Magnitude. It is of a Malleable Temper, and spreads under a Hammer more than any other Metal, and by the Hand of a skilful Artist, may be wrought into any Form or Shape. There is no solid Body that can be extended so much than Gold, one Ounce of it being capable to furnish 759 Leaves, each of four Inches square; and it is affirm'd, that one Ounce, thus beaten out, would cover 10 Acres of Ground. Wire-Drawers extend out of an Ounce of Gold a Thread of 230800 Foot long.

THE finest Metal, next to Gold, is Silver, which is of a more smooth and polished Nature than Gold, and is as malleable, but will not so easily yield or extend under the Hammer, neither is it so weighty as Gold.

SILVER is seldom found in Mines by itself, but commonly accompanied or mixed with *Copper*, *Lead*, or *Gold*: That mixed among *Lead* lies in a Kind of black Oar; but what is found in *Copper*, is for the generality in a hard white Oar, resembling Crystal. Sometimes Pieces of pure Silver are found in Mines, so hard that it cannot be melted without the Addition of a Quantity of other Silver.

### Of REFINING.

REFINING or purifying of Gold or Silver, is an Art by which the Impurities that are mix'd with these Metals, are separated, and this is generally done, when in large Quantities, by the \**Test*, and in small Quantities, by the †*Coppel*, in the following Manner.

TAKE

- \* The *Test* is a round Iron Ring, some are made Oval, about two or three, or more Inches deep; according to their largeness, and the Quantity of the Silver to be refin'd: This Ring is fill'd with Wood-Ashes well cleansed and pressed very close: At the Top there is a Cavity, commonly sunk with an Iron Canon-Ball, for to contain the Silver: Before the Ashes are quite dry, you put a Cloth over it with fine Ashes of Trotter-Bones, which you sift upon, through a fine Hair Sive, then place it on a Tile, in a Wind Furnace, cover it with a Muffel, and make it red Hot; when so, then put in the Silver to be refined. Vid. Plate I. Fig. 1.
- † The *Coppel* is made like an earthen Cup, not glas'd, but able to withstand the Fire; this is lin'd thorough with a Paste, made either of Wood-Ashes, or the Ashes of Bones, mixed up to a Mass with either strong Beer, Sifs, or the Whites of Eggs. The Wood-Ashes are wash'd in several Waters, till they have lost all their Filth and Salt, and the Water comes off clear and sweet, as when first put on. The Bone-Ashes loose their Salt in the Fire, and are commonly burnt of Trotter-Bones, or those of Calfs-Head,



a. The Ashes  
b. The Ring  
c. The Ring  
by two  
d. The Cup  
e. The Furnace  
f. The Hot  
press  
g. The Ring  
h. The Stone  
Support  
Receiver

Fig. 1.



Fig. 2.



Fig. 3.

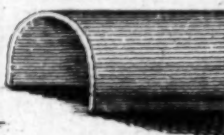


Fig. 2.



Fig. 4.



Hand Tongs

Crucibles

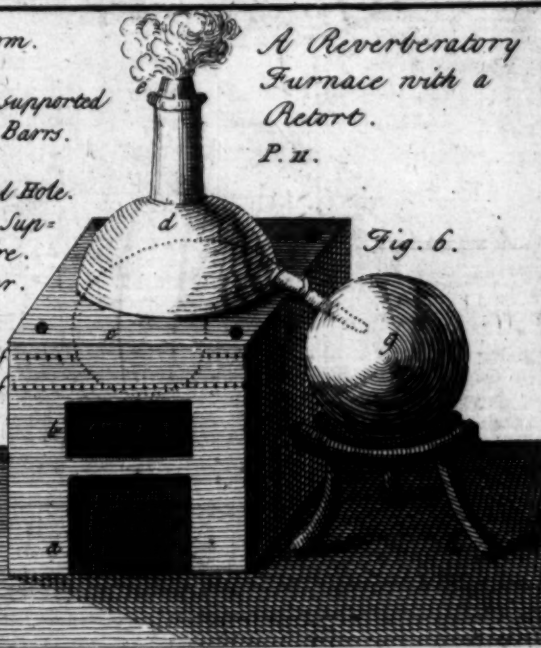


- a. The Ash room.
- b. The Heart.
- c. The Retort supported by two Iron Bars.
- d. The Cover.
- e. The Funnel Hole.
- f. The Holes to suppress the Fire.
- g. The Receiver.
- h. The Stool to support the Receiver.

A Reverberatory Furnace with a Retort.

P. II.

Fig. 6.







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TAKE your Coppel, and put it under a † Muffel, which cover all over with live Coals, adding dead ones to them, and by Degrees augmenting the Heat, till both the *Muffel* and *Coppel* are red hot. Then put, according to your Quantity of Silver, a proportionable Quantity of Lead into the *Coppel*, which is commonly four parts of Lead to one part of Gold or Silver. When the Lead is melted, and of a sparkling and fine Quicksilver Colour, then put your Gold or Silver upon it, and it will melt presently: Give it a brisk Fire, and the baser Metals will mix and unite with the Lead, but the Gold or Silver remain in the middle, clean and purified from all Dross, which fixes itself to the Sides like a Scum; this you take off, preventing its entering into the Pores of the *Coppel*; and this is what is commonly known by the Name of *Litharge*, and according to the Degree of Calcination becomes of diverse Colours; some is call'd *Litharge of Gold*, and some *Litharge of Silver*. Continue the Fire till you observe no rising of Fumes.

By these Means Gold and Silver is separated or purified from other Metals, except the Silver from Gold, or the Gold from Silver; the Separation of these two Metals being accomplish'd after another manner, commonly call'd *Departing*, and is perform'd in the following Manner.

*To separate Silver from Gold.*

PUT three Parts, or more, of Silver, to one part of Gold, into a Crucible, give it a brisk Fire, and when in Fusion, granulate it; then, after you have dry'd the Grains, put them into *Aqua Fortis*, wherein the Silver will dissolve, and the Gold will precipitate and settle to the Bottom, in a Powder. After the Gold is settled, pour off the Dissolution of Silver, wash the Gold Powder with clean Water, and sweeten it from all the sharpness of the *Aqua Fortis*: Then dry and melt it

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Heads, some prefer Fish-Bones before any other. The Ashes, which soever are used, must be sifted through a fine Hair Sieve. After having prepared this Paste or Mass, the Cup is lined all over the Inside very smooth and neat, leaving only a Cavity or a hollow in the middle, to hold the Matter that is to be Coppel'd, and then it is set to dry. The Size of these *Coppels* are made to the Quantity of the Metal to be purified. See Plate I. Fig. 2.

† A Muffel is made of one Part of Clay, mix'd with one Part of Sand, and two Parts of Horse Dung. Work up this, first in a square Flat, with a Rowling-Pin, to the Thickness of a Crown-Piece, and then bend it into an Arch, and let it dry. Some only use Pipe-Clay by itself. See Plate I. Fig. 3.

in a small Crucible, with a little *Borax* or *Saltpetre*; and when in Fusion, and looks of a bright Colour, cast it into an Ingot or Mould you have for that purpose.

To bring the Solution of the Silver into a Body, pour it in a thick-bottom'd Copper Bowl, that is thorough clean; add to it ten times the Quantity of clean Water, and the whole will turn of a Sky Colour; fling a little Salt into it, stir it about with a clean wooden Stick, and the Silver will precipitate to the Bottom, of the Consistence of a thin Paste: After it has settled for three Hours, or longer, pour off the Water into another clean Copper Bowl, and add some warm Water to the Settlement; this will also turn of a Sky Colour, but paler than the first: Repeat this till the Water comes off clear, and the Silver remains free from all Sharpness or Salt. Warm the first blue Water in the Bowl, fling a little Salt into it, and the Silver that remaind, will settle at the bottom. Pour off the Water, dry the Settlements, and then, after you have greas'd or wax'd your Crucible, melt them therein with a little *Borax*.

*How to granulate Silver in the best Manner.*

**T**AKE a Twig or two of a Birch Broom, with these stir the Water, in which you design to granulate, in a circular Motion, at the same time pour your Silver with discretion into it, between the Branches of the Twigs, and the Process will answer to your Satisfaction.

*To separate Gold from Silver.*

**T**AKE Silver, which contains Gold, as it comes from the Coppel or Test, granulate it, or else cast it into an Ingot; then hammer it into thin Plates, and cut them in little Pieces, so as to be easily convey'd through the Neck of the Matrafs. Then pour to one Ounce of Silver, two Ounces of *Aqua Fortis*; stop your Matrafs, yet so as to give it a little Vent; place it over a gentle Coal Fire, and let it leisurely advance to working and boiling, continuing it thus till the Silver is wholly dissolv'd, and the *Aqua Fortis* looks of a clear Colour. If the Silver contained any Gold, you will see it settled at the Bottom of the Matrafs, in a blackish Powder; but if there appears little or no black Settlement, it is a Sign the Silver contain'd no Gold.

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POUR off the Silver Water very gently and carefully into a Glafs or Pan, for in every Drop thereof is a Mixture of Silver; but take particular Care of the black Settlement, for that is the Gold Calx.

To this Silver Water put ten times as much of Rain or River Water, which is better than that of Springs; and at the Bottom of the Pan, put a Plate of Copper red hot; this will cause the Silver to precipitate to the Bottom, and by Degrees hang itself to the Plate, and cover it.

ON the black Settlement pour about an Inch heigh of clear Water, which will for the first and second time turn whitish, because of the Silver that remains therein; this Water put to that in the Glafs, and keep on pouring of Water on the Gold Calx, till it comes off clear. Then put the Gold Calx in a small Crucible, drain off the Water, and let it dry; mett it in the same Crucible with a little Borax, and you will have the purest Gold.

To try whether there is any Silver remaining in the Water; fling a little Salt in it, and let it stand all Night to settle; if there is any, the water will turn turbulent and cloudy, but if there is no Silver remaining, the Salt will settle at the bottom of the Glafs, and the Water remain clear. After it has settled 24 Hours, or more, pour off the clear Water from the Top, and the Settlement, which is the Silver Calx, put into a Crucible, which has been warmed, and the Inside wax'd all over; in this let the Calx settle, then pour off the clear Water: When the Calx is dry, melt it as has been directed, and you will have the purest Silver for Use. This is the shortest Manner of separating these Metals.

*To refine Gold when coarse, by casting it through Antimony.*

**T**AKE to one ounce of Gold four ounces of *Antimony*, melt the Gold in a proportionable Crucible; at the same time put the *Antimony* in another larger Crucible, and let that also be melted; when both are melted, cast the Gold into the melted *Antimony*, then make it red hot; when it is so, cast it into a Brass \*Cone, but let the Inside be a little warmed and greased with Tallow before you use it; then with a Piece of Wood, or with the Handle of a Hammer knock pretty hard and quick upon the

\* See the Figure of a Cone, Plate I. Fig. 4.



Rim, which helps the Gold's sinking to the Bottom; when cold, turn it out of the *Cone*, and you will see the *Regulus*; beat it gently off with a Hammer, and lay it by. Then take the *Antimony*, put it in the same Crucible, melt it as before, and separate it from the *Gold*: When turned out, you will find a little *Regulus*; and if you think you have not all your Gold, you may repeat it a third time. When this is done, in order to separate the remaining *Antimony* from the Gold, do it thus: Take a pretty large Crucible, put the *Regulus*, and a Handful of *Saltpeter* into it; then take another Crucible that fits in the former, make a Vent-Hole in the Bottom of it, and turn it upside down, that the Hole may come uppermost. When the wide Ends of the Crucibles fit well, take a Lutum, mix it with some pounded Glass, and lute it well; let it dry very well before a Fire; then take a Brick-bat, put it in your melting Place, and lute your Crucible upon it: Then lay a little Fire around it; upon that lay dead Charcoal, up to the Top of the upper Crucible, but take care the Hole be not covered: As the Heat of the Fire augments, so the *Saltpeter* goes off in strong Fumes through the Hole. When the Fumes cease, give it a strong Heat for an Hour long, or less, according to your Quantity; then take your Crucible out of the Fire, and let it cool; or else when you see the Crucible turn black, you may quench it in a Pail of Water; knock off the Bottom of the Crucible, and you will find your Gold, fine in a Cake; then take a clean proportionable Crucible, put a little *Borax* and the Gold into it, and melt and cast it into an Ingot. This is the finest Gold that can be.

*A Method of purifying Gold, by way of Cementation.*

**C**EMENTATION is a singular and useful Art, by which Gold may be purified from the Allay it may have of any other Metals; and this is done by Virtue of a moistened Powder, which eats and consumes the impurer Metals from it: But it is to be observ'd, that this Cementation is only to be made use of where the Gold has the Predominancy; otherwise if there should be more Silver or other Metal than Gold, it is better to perform the Separation with *Aqua Fortis*, as has been directed.

THE Cementing Powders are prepared of such Salts and Ingredients as attack, and with their Sharpness devour the Silver or Copper.

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To these are also added, \* *Æs ustum*, which gives the Gold a fine Colour; *Blood-stone*, *Tutia*, *Crocus Martis*, calcin'd *Vitriol*, and several other Things, as are inducive to advance the Beauty of that Metal.

BRICK Dust is used in this Cement, in order to receive the Allay, let it be Silver or Copper, or what it will, from the Ingredients that draw and separate them from the Gold, which otherwise would stick and hang to the Gold. I shall here set down a few Receipts of such Cements as have been experienc'd, and are approv'd off.

TAKE fine Brick Dust, one part, and fine beaten Salt, one part, moisten and mix it with Vinegar, and with it fill a Crucible half full, then stratify Plates of Gold, or Gold Coin, and the foresaid Mixture or Paste, and press it close down; repeat this as you have Occasion, and give it a thick Lay at Top; then cover and lute the Crucible close, that nothing may evaporate: When this is done, fix your Crucible upon a high Brick, in the Middle of the Furnace, give it a violent Heat for 12 Hours, and the Salt will eat and consume the Impurities of the Gold, and draw it into the Brick-Dust.

*Another.*

TAKE in Weight one part of Saltpeter, one part of Alum, one part of Sal-armoniack, two parts of Vitriol, four parts of Salt, eight parts of Brick-dust, and mix it with Vinegar; stratify this and the Gold, as before directed, in the Crucible; cover and lute it well, and give it a violent Fire for an Hour or two and let it cool of itself; but before it is quite cold, take out the Gold, fling it into White-Wine Vinegar, and boil it therein; then brush it, and after you have done this, heat it red hot upon an Iron Plate.

*Another.*

TAKE Blood-stone two Ounces, Rust of Iron one Ounce, calcined Vitriol one Ounce, Sal-armoniack one Ounce, Verdegrease one Ounce, Boli-armeniæ  $\frac{1}{4}$  of an ounce, Tutia  $\frac{1}{4}$

\* *Æs ustum* is prepared thus: Stratify Plates of Copper with powdered Sulphur in a large Crucible, cover and lute it with a Cover that has a Hole in the Middle; to give vent for the Fumigation, give it a strong Fire in a Wind-Furnace, so long till you see no exhalation of Vapours; then take off your Plates whilst hot, separate them, and when cold, beat them to a Powder. Which is the *Æs ustum*.

of an ounce, Salt-petre  $\frac{1}{4}$  of an ounce, Allum  $\frac{1}{4}$  of an ounce; moisten this three or four times with Vinegar; let it dry between while, grind it fine, and proceed as directed; give it a strong Fire for three Hours; which repeat three times.

To bring the Silver out of the Cementing Powder or Brick-dust, mix it with Glass and granulated Lead, let it melt together, put it to the Test, and you will have the Silver again which was in the Gold.

*To separate Gold and Silver, out of the Sweepings.*

**T**AKE Sweepings, put them into a Pan well glazed, add Mercury to them, in Quantity as you think proper; mix and mingle the Dust and Mercury with your Hands well together, so long till you think the Mercury has contracted all the Gold and Silver from the Dust; then put the Mass into a Piece of Wash-leather, and wring out the Mercury, what remains in the Leather will be like a Paste; put that into a Alembick, and drive the Mercury from it into a Dish with Water, which you put under the Head to receive it; what remains, put to the Test, refine it with Lead, and separate it with *Aqua Fortis*.

*To separate the Gold from gilded Copper.*

**T**AKE four ounces of yellow Brimstone, two ounces of Sal-armoniack, one ounce of Saltpetre, half an ounce of Borax; take these and grind them fine and clear with strong Vinegar, to a Paste; this wipe thin over the gilded Copper, give it a gentle Heat, till the Paste is burned away, and the Copper looks black, then take it out, and with a Knife or other such Instrument scrape off the Gold in a clean Dish, and it will come off very easy.

*Another Method.*

**T**AKE the Root of *Bertram*, cut it fine, pour one Quart of strong White-wine Vinegar upon it, put it into a boiling-Pot, cover it with a Lid, lute it well, and let it boil a little, then take it from the Fire, and let it cool. After this take your Copper Cup or other Thing that is gilded, Neal it well, quench it in that Liquid, and the Gold will peel off the Copper and fall to the Bottom, which wash, and then melt together in a Crucible.

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*Another Way.*

**T**AKE fine Sal-armoniack two parts, Sulphur one part, grind it well together, anoint your Work with Linseed Oil, strew the Powder upon it, hold the Utenfil of Copper to the Fire, over an earthen Dish with Water; beat against it with an Iron, and the Gold will fall off into the Dish.

*Another Way.*

**T**AKE Saltpetre and Borax, one ounce of each, dissolve it in a little Quantity of Water, then Neal your Copper, and quench it in this Water; repeat this several Times, and the Gold will fall to the Bottom.

*Another Way to separate the Gold from any gilded Metal, Silver or Copper.*

**T**AKE one part of Borax, and three parts of live Sulphur, grind this together with very strong White-wine Vinegar, as thick as Oil Colour; with this wipe the gilded Side of the Metal, let it dry gently before a Fire, and when dry, wipe this Composition with a Feather, into a Bason with Water; wash and melt it, as has been taught before.

*To separate Copper from Silver, let it be Money or any Thing else.*

**T**AKE half an ounce of Verditer or Spanish Green, White Vitriol one ounce, Sulphur one ounce, Allum half an ounce; seeth all together in Vinegar; in a Glasse, put in your mixt Silver; this will dissolve and extract the Copper, and the Silver remain whole.

*To extract the Silver out of a Ring that is strong gilded, so as to keep the Gold intire; a curious Secret.*

**T**AKE a Silver Ring that is strong gilded, pierce a little Hole through the Gold into the Silver, then lay the Ring into Spirit of Nitre, and put it in a warm Place; it will hollow out the Silver, and the Gold remain whole.



*To make Brittle Gold malleable.*

**P**UT Gold into a Crucible, and give it a brisk Fire in a Wind-Furnace, or before the Bellows; when the Gold is nigh melting, then sling gently upon it some good, dry and clear *Salpetre*, which will presently turn into Flames, and occasion the Fusion of the Gold the sooner, and the *Salpetre* will spread and cover the Gold; then cast it into an Ingot, which before has been warm'd and anointed over with Wax.

*Another Method.*

**T**HE best way of all to make Gold malleable, is this: Take human Excrements, which dry, and calcine in a Crucible to a black Powder; when the Gold is in Fusion, then sling some of this Powder upon it, and give it a brisk Fire; when the Powder is consumed, cast the Gold into an Ingot, and it will be fine and malleable: If you extract the Salt from the black Powder before you use it, it will still have a better Effect, and that with a less Quantity.

*To make Silver that is brittle, pliable.*

**T**AKE one Mark of Silver, half an Ounce of Glass, one Ounce of Saltpetre, a quarter of an Ounce of *Borax*, half an Ounce of *Sal Gemme*; put all this into a Crucible, and cover it with a lesser one that has a Vent-hole at Bottom, and lute it well; Then give it a brisk Fire, and continue it so long 'till you think the Silver is dissolv'd; then cover the Crucibles all over with live Coals, except the Vent-hole, and leave it till cold: Take off the Upper Crucible, and you will find therein hanging all the Filthinels and Impurities the Silver contain'd, and was the Occasion of its hardness: Then melt the Silver again in a Crucible, and sling into it half an Ounce of *Tartar* finely ground, and when in Fusion, cast it into an Ingot, and you will have fine and malleable Silver

*To give Gold, Silver or other Metals a good and quick Fusion.*

**T**AKE calcined *Venetian Soap*, *Borax*, *Glass-gall*, or *Venice Glass*, of one as much as the other, grind it well and mix it together, it will cause a quick Fusion.

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**T**AKE yellow Amber, Borax, Glafs-gall and Soap, even Quantities, grind them together to a Powder, and what you design to cast, let it be melted with that Composition.

*To try whether granulated Silver contains any Gold.*

**T**AKE some of those Silver Grains, and rub them on a Touch-stone; then with the End of a Feather drop one or two Drops of *Aqua Fortis* upon the Strokes, let it stand upon it for a little while; if it contains Gold, you will see some remains of the Strokes, but if not, the Strokes will be vanish'd.

*To Amalgamate Gold, or to mix it with Mercury, useful for Gilders.*

**T**AKE a penny-weight of fine Gold, beat it in very thin little Plates; heat them in a Crucible red hot, then pour upon it 8 penny-weight of Quicksilver, † revived from Cinnaber; stir the Matter with a little Iron Rod, and when you see it begin to rise in Fumes, which quickly happens, cast your Mixture into an earthen Pan, fill'd with Water, it will coagulate, and become tractable; wash it several times to take away its Blackness; Thus you have an *Amalgama*; from which separate the Mercury which you find is not united, by pressing it between your Fingers, after you have wrapt it in a Linnen Cloth.

*Gilding upon Silver, Brass, Copper, and Iron.*

**I**F you will gild Silver, take of the foresaid *Amalgama*, and with it rub that which you design to gild, close

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† Reviving of Quicksilver from Cinnaber, is thus perform'd: Take a pound of Artificial Cinnaber, powder it, and mix it exactly with three Pound of Quick lime, also powdered; put the Mixture into an Earthen Pot, or Glafs Retort, whose third part at least remains empty, place it into a Reverberatory Furnace, and after having fitted to it a Receiver filled with Water, let it rest 24 Hours at least, give your Fire by Degrees and at last encrease it to the Height, and the Mercury will run in Drops, into the Receiver; continue the Fire untill no more will come; the Operation is commonly at an End in six or seven Hours: Pour the Water out of the Receiver, and having wash'd the Mercury to cleanse it from the little portion of Earth it might carry along with it, dry it with Linnen or the Crums of Bread, and keep it for Use. *Lemery.*

every

every where, that the Gold may be received all over, then hold it over a Charcoal Fire, or lay it upon it, and it will cause the Quicksilver to fly away, after which you heighten the Colour with Gilding-Wax, as shall be directed.

*A particular Secret, to Gild Silver to the greatest Perfection.*

TAKE \* *Crocus Veneris* and Vinegar, put into it Quick-silver, let it boil together, till it comes to the Consistence of a Paste; with this quicken (anoint or wipe over) the Silver you intend to gild, and where-ever you quicken, it will turn of a reddish Gold Colour, which doth not happen when done with *Quicksilver* only, for then it looks white: This is a curious Secret; you may gild upon this Paste with Leaf Gold, when otherwise it requires to be ground; it makes the Gilding look rich and of a high Colour.

*Another Advantageous Gilding on Silver.*

TAKE Tartar one part, Salt two parts, pour Water upon it, add to it some Steel Filings, boil the Silver therein, till it becomes reddish, and this will require only the third Part of what Gold you would use otherwise.

*A particular Method of Gilding, which may be done in a Moment, and better than with Quicksilver.*

TAKE the finest Gold, dissolve it in † *Aqua Regis*, which has been prepar'd with Salt, let the *Aqua Regis* be evaporated to half the quantity; then put the Glafs into a damp Cellar, on Sand, and the Gold will over Night shoot into Crystals, which take out, and let them dissolve again in

\* Take the Slips of Copper, and squench them in Urine, repeat this till it easily pulverizes. The Powder you will find at the Bottom of the Urine, which preserve for Use.

† The Preparation of this *Aqua Regis* only differs from the following Receipt, in using of Salt instead of *Sal armoniack*; the usual Way of making *Aqua Regis*, according to *Lemery*, is thus:

Powder four Ounces of *Sal-armoniack*, and put it into a Matrafs or other Glass Vessel of a good Bigness, pour upon it 16 Ounces of *Spirit of Nitre*, place the Vessel in Sand a little warm, until the *Sal-armoniack* is all dissolv'd, then pour the Dissolution into a Bottle, and stop it with Wax. This is the right *Aqua Regis*.

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still'd Vinegar, put it again upon the Fire, and let the half thereof evaporate, then put the Glas again in the Cellar, as before, in moist Sand, and over Night the Gold will shoot in Crystals. These dissolve in Rain Water, let that evaporate to half the Quantity, and again shoot into Crystals; when this is done, take the Crystalline Gold, break it to a Powder with a Knife, put that Powder into the White of an hard boil'd Egg, after the Yolk has been taken out, set it in a cool and damp Place, and over Night it will dissolve to an Oil; and what Silver you anoint with, ever so thin, drying it gently, you will find the Gilding of a high and fine Colour, to the greatest Perfection.

*A Gilding after the Grecian Manner.*

**T**AKE \* *Mercur. Sublimat.* and clear *Sal-armoniac*, of each one Ounce, make a Solution thereof in *Aqua Fortis*, then dissolve in it fine Gold which is beaten very thin; let this Solution evaporate over a Coal Fire, till it becomes an Oil, then dip in it a Silver Wire; if it comes out black, and by nealing it in the Fire, turns out gilded, it is right, and fit to be used for gilding any Sort of Silver.

*A right Italian Gilding.*

**T**AKE common Vitriol four Ounces, Allum two Ounces, White Vitriol one Ounce, *Plum. Alb.* one Ounce, Salt two Handfuls, River-Water one Quart, let it boil to half, then let it stand till it settles and looks clear, and it is fit for Use.

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\* Mercury sublimate or sublimate Corrosive, is a Mercury that's impregnated with Acids, and by Fire is raised to the Top of the Matrafs or other Vessel.

Put one pound of Mercury, reviv'd from Cinnaber, into a Matrafs, pour on it 18 Ounces of *Spirit of Nitre*, set it on a warm Sand, and let it stand till all is dissolv'd; this Dissolution put into a Glas Vessel or Earthen Pan, set it on warm Sand to evaporate all the Moisture, the remains will be a white Mass, which beat to Powder in a Glas Mortar, and mix with one Pound of white calcin'd Vitriol and as much decriptated Salt; put this Mixture into a Matrafs, so as to leave two thirds empty; place it in Sand, give it first a gentle warmth for three Hours, then augment the heat with laying on more Coals, and a Sublimate will rise to the Top of the Matrafs: The Operation will require six Hours Time, when the Matrafs is cold, break it, but take care to avoid a Kind of light Powder that flies in the Air, when the Matter is stirred. You will have one Pound and above of very good Sublimate Corrosive.



*To deaden Quicksilver for Gilding.*

**T**AKE clear Quicksilver which is free from the Mixture of Lead, put it into a Matrafs, and fling into it a handful of fine white Salt, shake it well together, and let it stand for two days, then pour upon it strong Vinegar, let it rest a Day, and you will find a good Quicksilver for gilding, and come cheap.

*A Gold Powder.*

**T**AKE Leaf Gold or other thin beaten Gold, to the Quantity of a Penny-Weight, or as much as you please, dissolve it in twice the Weight of *Aqua Regis*. Let half the Solution evaporate on warm Sand, then take dry'd Linnen Rags, soak them in the remaining Liquid, dry them by a gentle Heat, and burn them on a slow Fire in a Crucible, the Powder whereof will remain at the Bottom, and be of a yellowish Colour, wherewith the gilding is performed.

*Another for cold Gilding.*

**T**AKE half a Pound of *Aqua Fortis*, put in it two Ounces of Sal-armoniac finely pulverized and white, let it dissolve over a Fire, and then filter it through a Paper; put it into a Matrafs, with as much fine beaten Gold as will make two Penny Weights; set it on a slow Fire, in order to dissolve the Gold in the *Aqua Regis*. When this is done, add to it two Ounces of *Sal-gemma*, fine and clear, powdered, and let it dissolve upon the Fire; then take fine clean linnen Rags, each about  $\frac{1}{4}$  of an ounce in Weight, dip them into that Liquid, till all the Solution is soaked in, and having dried them, burn them to a Powder, which preserve for Use. When you gild any Thing with this Powder, let the Metal you design to gild be boiled and scraped, to have it clean and fresh; wet a Piece of Cork with Spittle or Water, and with it take up some of the Powder, rubbing the Places of the Metal you are about to gild, till it is yellow, after which brush and polish it. You may use instead of Cork, a soft Leather sowed or tied to a round End of a little Stick.

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*Another Method.*

**T**AKE of the finest Gold the Quantity of two Penny-weight, and dissolve it in *Aqua Regis*; add to this Solution the Weight of the Gold refined *Salpetre*, let that also dissolve; this done, dip a fine little linnen Rag, till it is all soak'd up, dry it gently, and burn it to Powder. With this Powder and fresh Water gild your Silver, by rubbing it with your Cork, or a Leather, fastened to the Knob End of a Stick.

*Another Powder to Gild withal.*

**T**AKE refined Gold, beat it very thin, roll it in little Rolls, sing it in *Aqua Regis*, hold it in a Matrafs over a slow Fire, till all the Gold is dissolv'd, and the Solution is turned of a yellow Colour, then sing into it some pulverized Crystalline *Salpetre*, by little and little, as much as it will consume; then take some long narrow Slips of old fine Linnen, draw them through that Liquid, and when they are thorough wet, hang them into the Air to dry, in a Glass Bowl, or a Piece of a broken Bottle, and when thoroughly dry, light them with a Coal, and let them thus, without Flame, consume to Ashes. With these Ashes you may gild, rubbing it on the Silver a Piece of Cork.

*Another.*

**T**AKE a Penny-Weight of Gold; put the same Weight of *Salpetre*, also the same Weight of *Sal-armoniack* into a Matrafs, to three Quarts of *Aqua Fortis*; then put the Gold nealing hot into it, and as soon as the Gold is dissolved, take some dry Linnen Rags, dip them therein, dry and burn them at a Candle to Tinder, which preserve for Use, as has been mentioned.

*A Quickening Water.*

**T**AKE one Ounce of Quicksilver, one Ounce of *Aqua Fortis*, let it be put together into a Glass, and after the Quicksilver is dissolv'd, put to it five Ounces of fresh Water; warm it, and it will be fit to gild withall.

*Another.*

*Another.*

**T**AKE one Ounce of *Aqua Fortis*, put it into a Matrafs add to it  $\frac{1}{4}$  of an ounce of Mercury, let this dissolve; then take fresh River Water, and mix it with that in the Glafs, to that Degree that you may put your Hands in without hurting them; then let it stand closed up, and you will have a good Quick-Water for gilding.

*Another Water-Gilding upon Silver.*

**T**AKE Copper-flakes, pour strong Vinegar thereon, add to it Allum and Salt, of one as much as the other, set it on a Fire, and when the Vinegar is boiled the fourth part away, sling into it what Metal you design to gild and it will attract a Copper Colour. If you let it boil on further, it will change into a fine Gold Colour. This is a fine Secret for Goldsmiths, to gild Silver all over, for the boiling it in that Liquid, gives the Gold a high and rich Colour.

*A Method to Work a Cup, One Side Gold and the other Silver.*

**T**AKE a Piece of fine Silver, form it into a flat Square, and with a rough File, rough it all over one Side; raise also with a Graver little Points upon it. Then take a Piece of Gold in Proportion to what Thickness you would have it; form it exactly to the Dimension of the Silver, in a flat Square; Neal both the Gold and the Silver red Hot; then lay them quick on one another, and with a wooden Hammer beat it gently together: When thus you have united these two Metals, you may form thereof what you please, one Side will be Silver and the other Gold.

*To embellish Gold, Silver, or Brasse, with Ornaments of Glasse.*

**T**AKE fine pulverised Venice Glasse of what Colour you please, grind it upon a Stone, temper it with Oil, then put it in Circle of a clear Charcoal Fire to melt, it will look fine and beautiful, especially if the Ornaments and Things are well design'd.

OF



Of several Sorts of Gold-Colours, Gilding-Wax, and other Embellishments of Gold or Gilded Work.

**T**HE Gold, as well as gilded Silver, wants considerably of that Lustre and Brightness it appears in, after it is placed in Goldsmiths Shops; for before this, it undergoes several Operations, and is raised to its Beauty by *Gilding-Wax*, *Colouring*, and *Helling*; each of which shall be separately explain'd under the following Heads.

*Gilding Wax used for Gold, or gilded Work.*

**T**AKE four ounces of clear Wax, one ounce and a half of Verditer, one ounce of Copper Flakes, one ounce of Red Chalk, one ounce of Alom; melt the Wax, and put the other Things, finely powdered, into it, and stir it well together: let it cool and form thereof round Sticks like Sealing-Wax: When you have Occasion to make use of it, then first heat your Gold, and then rub it over with this Wax; Then Neal it, and draw it nimbly through boiling hot Water and Tarter, and it will give the Gold a deep Colour.

*Another.*

**T**AKE two pound of Wax, one pound of Red Chalk one pound of White Vitriol, and four ounces of *Æsustum*.

*Another.*

**T**AKE 12 ounces of fine yellow Wax, eight ounces of Red Chalk, four ounces of Verditer, two ounces of *Æsustum*, one ounce of Vitriol, half an ounce of Borax; melt the Wax slowly in a glazed Pipkin, on a gentle Fire, not too hot; then put the fore-mentioned Things one Spoonful after another, into it, stirring it, till you have mixt it well, and when cool, form it into Sticks for your Use. Let every Matter be ground by itself, the finer the better.

C

*Another.*



*Another.*

**T**AKE 16 ounces of Wax, one Grain of Copper Flakes, three ounces of Vitriol, four ounces of Verditer, and nine ounces of Red Lead.

*Another.*

**T**AKE eight Ounces of clear Wax, one Ounce and a half of *Terra Vert.* one Ounce of *Æs ustum*, one Ounce of red Chalk, and half an Ounce of Alom; dissolve the Wax, and put these Ingredients in; let it cool; then form it into Sticks like sealing Wax; with this, after you have heated your gilded Metal, rub it over; then burn it off, and it will give the Geld a deep Colour.

*Nurimberg Gilding-Wax.*

**T**AKE two Pound of Wax, two Pound and one ounce of Red Chalk, one ounce of Vitriol, half an ounce of *Æs ustum*, three ounces of Verdegreafe, half an ounce of Borax.

*Another.*

**T**AKE two Pound of Wax, one Pound of Red Chalk, one ounce of Verditer, three Grains of *Æs ustum*, three ounces of Verdegreafe, and two ounces of Borax.

*Another.*

**O**NE Pound of Wax, one Pound of Red Chalk, one ounce of Verditer, three Grains of *Æs ustum*, two ounces of Venice Borax, two ounces of Vitriol.

*Another.*

**T**AKE four pound of clear Wax, one pound eight ounces of Red Chalk, one pound eight ounces White Vitriol, 15 ounces of Verdegreafe, three ounces of Venice Borax, 15 ounces of *Æs ustum*, beat it fine, mix it together, and when the Wax is melted, stir it, till you perceive it to cool; then put in the Ingredients, and stir them well together, and when cold, form them into Sticks like Sealing-Wax.

Of

Of several Gold Colours, whereby the Gold or gilded Work, after it has been heightened with Gilding-Wax, receives its proper Colour.

*A Silver Gold Colour, or a Colour for gilded Silver.*

**T**AKE one ounce of Verdegrease, one ounce *Salt-petre*, one ounce Vitriol, half an ounce *Sal Armoniac*, half an ounce of Borax, grind them fine; boil it in half a Pint of Urin to half the Quantity; then with a Brush dipt in this Liquid, brush over your gilded Work; put it upon a clear Charcoal Fire, and when you see it turn black, take it off the Fire, and quench it in Urin.

*A Green Gold Colour.*

**T**AKE two ounces of Salt-petre, two ounces of Vitriol, two ounces of Verdegrease, and one ounce of *Sal-armoniac*, mix and grind them with Vinegar.

*Another.*

**T**AKE four ounces of Verdegrease, four ounces of *Sal-armoniack*, two ounces of Vitriol, two ounces of *Æs ustum*, one ounce of Salt-petre, grind them with Vinegar, and colour your Gold therewith.

*A French Gold Colour.*

**T**AKE four ounces of Salt, two ounces of Alum, two ounces of *Sal-armoniac*, two ounces of *Æs ustum*, one ounce of Salt-petre, and grind them with Vinegar.

*Another.*

**T**AKE four ounces of *Sal-armoniac*, four ounce of Verdegrease, two ounces of Salt-petre, one ounce and a half of clean Copper-Flakes; grind it with Vinegar.

*A fine Gold Colour.*

**T**AKE melted Salt-petre, and black Vitriol, of one as much as the other, let it boil half away in a clean Pipkin.

*Another Gold Colour.*

**T**AKE one ounce of Verdegrease, one ounce of Sal-armoniac, one ounce of Red Chalk, one ounce of fine Salt, grind all together, and boil it with Vinegar.

*Another.*

**T**AKE one ounce of Salt-petre, one ounce of Verdegrease, one ounce of Vitriol; one ounce of Sal-armoniac, grind each Piece separately in a clean Morter; then mix and put it in a clean Pan, with Water, and boil it for almost half an Hour.

*A Green Gold Colour.*

**T**AKE four ounces of Sal-armoniac, four ounces of Verdegrease, one Grain of Salt-petre, and grind it in Vinegar.

*A White Colour for Gold.*

**T**AKE two ounces of Salt-petre, one ounce of Alum, one ounce of Salt; pulverize and mix this well together; then take a piece of a broken Muffle or Crucible, put it in the Fire; and let it be red hot; wet the Work you design to colour, and roll it in the Powder; then put it on the red hot Piece of the Muffle, and the Colour will ebullate; when it melts, turn the Work with your Tongs about; when the Colour is quite fluid and yellow, take the Work out, and lay it upon a clean Brick or Anvil till it is cold. Then take an unglaz'd Pot, or else a large Crucible; fill it almost up with clean Water, put into it a Handful of Salt, the Bigness of a Filbeard of Tartar, ground; and six or eight Drops of *Aqua Fortis*; let that boil; then put your Work into it, and boil it so long, till the Dross of the white Colour is clean off, then Scratch-brush it.

*To colour an old Gold Chain, as new.*

**T**AKE Urin, dissolve therein Sal-armoniac, boil in this the Gold Chain, and it will have a fine Colour.

*A Green Colour for Gold Chains.*

**T**AKE four ounces of Sal-armoniac, four ounces of Verdegrease, one ounce and a half of Salt-petre, half an ounce of white Vitriol, make a Powder thereof, mix it with Vinegar, and boil your Chain in it.

*To give Gold a high and fine Colour.*

**T**AKE red calcin'd Vitriol three ounces, Sal-armoniac two ounces, and Verdegrease one ounce; grind them together, and keep it dry. When you will colour your Gold, moisten it, and strew this Powder over it, let it often neal, and quench it in Pump-Water.

*Another fine Colour for Gold.*

**T**AKE Verdegrease, Sal-armoniac, Salt-petre, and Vitriol, of one as much as the other, grind it well together; pour Vinegar upon it, grind it again, as the Painters do their Colours, and let it dry; then moisten, grind, and dry it again; repeat this for several Times: Then lay up your Powder carefully, and when you will colour Gold, wet it with Urin, rub it with a Brush, then fling the Powder upon it, lay it on red hot Coals, and it will turn black, then quench it in Urine, and rub it with a Wire-Brush; in this Manner you proceed with the other Colours.

*To bring Pale Gold to a high Colour.*

**T**AKE Verdegrease, pour Vinegar upon it, stir it well, anoint your Gold therewith, heat it in the Fire, and quench it in Urin.

*To make Silver throughout Tellow, and to tincture it the Colour of Gold.*

**T**AKE common Aqua fortis, dissolve therein as much Silver as you please; if you have eight Ounces, take  
C 3 four



four Ounces of *Hepatic Aloës*, six Ounces of *Gurgumi*, two Ounces prepared *Tutty*, that has been several Times quench'd in Urin; put these to the Solution of the Silver, and they will dissolve, and raise up in the Glass like a Sponge; the Glass must be large, to prevent the running over; then draw it off, and you will have ten Ounces of Silver, which is yellow as Gold. *N.B.* These two Ounces, increased in the Weight of the Silver, will not stand the Test, but be lost when melted down with Lead.

*A Water to Tincture any Metal of a Gold Colour.*

**T**AKE fine Sulpher, and pulverize it; then boil some stale Spring or Rain Water, pour it hot upon the Powder, and stir it well together; boil it and put into it one Ounce or more of Dragon's Blood, and after it is well boil'd, take it off and filter it through a fine Cloath: Put this Water into a Matrafs, after you have put in what you design to Tincture; close it well and boil it, and the Things will be of a fine Gold Colour.

*Another Water wherewith one may tinge any Metal a Gold Colour; a curious Secret.*

**T**AKE *Hepatic Aloës*, Salt-petre, and Roman Vitriol, of one as much as the other, distil it with Water in an Alembick, give it fire so long till all the Spirits are extracted; it will at last yield a yellowish Water, which will tinge any Sort of Metal a Gold Colour.

*To colour Gold.*

**T**AKE a Lock of human Hair, of about a Fingers thick, lay it on live Coals, and hold the Gold with a pair of Tongs over it, to receive the Fumes thereof.

*To give Gold a high and fine Colour.*

**T**AKE one Ounce of *Sal-armoniac*, two Ounces of Copper Flakes, one Ounce of distill'd Verdegreafe; grind all well together, put it into a Matrafs, pour upon it one Quart of good distill'd White-Wine Vinegar: Let it thus dry and boil away; then grind it fine; strew it on a Glass Plate, and set it in

in a Cellar, where it will turn into an Oil; this is again to be gently coagulated, then ground and mix'd with Mercury Sublimate; put half an Ounce of it, wrapt up in Bees-Wax, into the Quantity of a Pound of Gold that's in Fusion, and it will give it a high and fine Colour.

*To give the Gilded Work a fine Colour.*

**T**AKE clean Salt and Brimstone, boil it together with Water in an Egg-shell, after you have peeled the inside Film; take care you don't give it too much Fire to burn the Egg-shell: With this Liquid wipe over your Gilding, and it will make it of a much brighter Colour than it was before.

*Another.*

**T**AKE Powder of Sulpher, and bruised Garlick, boil these in Urin, Neal your Gold, quench it therein, and it will give it a fine Colour.

*To brighten Spots in Gilding.*

**T**AKE Alom, boil it in clean Water, put your Work into it, this will fetch the Colour again, and dispel the Spots.

*To give old Silver Lace or Trimmings their Beauty and Colour, as if new.*

**T**AKE Powder of Alabaster, put it dry into a Pipkin, and let it boil as long as it can; then take it off the Fire, and when cold, lay your Lace upon a Cloth, and with a Comb-Brush, take up some of that Powder, and rub therewith both Sides, till it is as bright as you would have it, afterwards polish it with a smooth Stone.

*Another Method.*

**T**AKE Ox-Gall, and the Gall of a large Jack, and some Water, mix it together, and with it rub your Gold or Silver, and you will see the Colour change to your liking.



## Of the HELL, or HELLING of Gold.

This is the finishing Stroke of either Gold or gilded Work, and is perform'd after it has undergone the Operations with the Gilding-Wax and Gold Colours as has been shewn in the preceeding Articles. The following are the different Receipts of different Masters. The ingenious and judicious will by experimental Enquiry soon discover which of them is best, and make his Choice of such as he approves.

*The Hell of Gold, or gilded Work.*

**T**AKE two ounces of Tartar, two ounces of Sulphur, and four ounces of Salt; boil this in half Water, and half Urin, dip your Gold or gilded Work into it, and it will give it a fine Lustre.

*Another.*

**T**AKE eight ounces of Salt, two ounces of Tartar, two ounces of Sulphur, two ounces of *Cap. Mort.* half an ounce of Alom; if you boil this in Water and Urin, and draw your Work through, it will answer your Expectation.

*Another.*

**T**AKE eight ounces of Sulphur, eight ounces of Alom, eight ounces yellow Arsenick, 16 ounces of Tartar, 16 ounces of Salt; boil it in Water and Urin.

*Another.*

**T**AKE three ounces of Sulphur, one ounce of Alum, one ounce of Arsenick, half an ounce of *Gurgumi*, and half a Grain of Antimony, grind them very fine together; then boil them in Urin and Water, and stir the Ingredients by little and little well together, give it a little boiling, put the gilded Plate into it, and boil it till the Colour is bright.

*Another.*

*Another.*

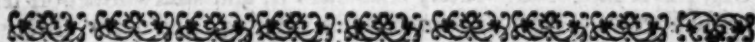
**T**AKE eight ounces of yellow Arsenick, 16 ounces of Sulphur, 16 ounces of Tartar, 16 ounces of burnt Alom, three ounces and a half of Salt; boil it in Urin and Water.

*Another.*

**T**AKE sifted Ashes and Antimony, finely pulveriz'd, with these make a Lee, and with a Brush rub over the gilded Silver.

*Another.*

**T**AKE one ounce of white Tartar, one ounce of green Sulphur, nine ounces of Salt; grind it together like Flower; then take a Copper Sauce Pan with fresh Water, and let the Water boil; put into it one Grain crude yellow Arsenick; take of the grounded Ingredients three Spoonfuls, and let it boil; after that, you may draw your Work through, and make it as high as you will, it will come out clear and with a fine Lustre.

*How to take off the Gold from gilded Silver Tankards or Cups.*

**T**O take off the Gold from such Plate, take *Sal Armoniack* one part, *Sal-petre* one half part, grind them both to a Powder, wipe over the gilded Part with Oil, strew the Powder upon it, and lay your Plate into the Fire to heat it well; then take it out; hold your Plate over an earthen Dish, in one Hand, and with the other beat it with an Iron, and the Powder will fall into the Dish, together with the Gold, which you may separate in the Manner as has been directed.

*Another Method.*

**P**UT Quicksilver in an earthen Dish, heat it so much as just to suffer your Finger in; in this turn your  
Silver



Silver Cup or other Utensil, and the Gold will separate from the Silver, and join the Quicksilver; when you see the Gold all off the Plate, take it out, pour the Quick-silver with the Gold, after it is cool, into another Dish, and if any Place still retains some Gold, repeat it, till you perceive no more upon it; then strain the Quicksilver through a Leather; what remains put into a \* Retort, and on hott Sand or Ashes force the rest of the Mercury from it into a Receiver with Water, and what is left, melt together, and refine the Gold as has been taught before.

*An approved Method to take off the Gilding from Silver.*

**F**IRST take a Glass, or a glazed Utensil, with *Aqua Fortis*, the Quantity whereof must be according to the Bigness of your Work; take no more than half  $\frac{1}{2}$  of an ounce of *Sal Armoniack* to one Ounce of *Aqua Fortis*; beat your *Sal Armoniack* fine; put it into the *Aqua Fortis*, and sett it over the Fire, till it grows warm; and when you perceive the *Sal Armoniack* to work, then lay in the gilded Silver, and when you observe your work to change to a black Colour, then the Gold is off on it; if there is a pretty large Quantity of Work, let it lay for half an Hour or an Hour before you take it out, which you do with a Pair of wooden Plyers; when it is taken out, put it into clean Water, then Neal it, and afterwards boil it with Tartar; repeat this three times running, and your Silver will look fresh and new.

*How to get the Gold out of Aqua Fortis.*

**T**AKE a Copper Bowl or Cup, put into it a Glass full of Water, then pour in the *Aqua Fortis* which contains Gold, in Order to sweeten it a little; then put to it  $\frac{1}{4}$  of an ounce of Venice Borax, and boil it up; let it stand over Night; in the Morning pour it off gently, and the Gold will be settled at the Bottom; dry it by Degrees, and when dry, put a little Borax to it, and melt it.

\* Vid. Plate I. Fig. 6. The Neck, through which the Mercury is conveyed, must be half Way in the Water, that's in the Receiver.

*To separate Gold from gilded Silver, by Cementation.*

**T**AKE red calcined \* Vitriol or *Colcothar* one part, Salt one part, also red Lead half a part, pulverise and mix it all well together; with this mixed Powder cover your gilded Silver all over in an earthen Pan, put it into a Furnace, and give it a slow Fire, to prevent the Melting of the Silver; the Powder will contract the Gold, which you reduce by Melting it with Lead, and by Separating it in the Coppel.



Of several Sorts of SOLDER, used for GOLD and SILVER.

*Filings-Solder for Silver Chain-Work.*

**M**ELT three parts of fine Silver and one part of Brass; when in fusion, sling into it a little quantity of yellow Arsenick. Or,

Take one part yellow Arsenick, and one part of Copper, melt and granulise it; Of this take one part, and of fine Silver four parts; melt it together; cast it into an Ingot, and when cold file it to a fine Dust.

*A Solder for Silver.*

**M**ELT two parts of Silver, then put to it one part of thin beaten Brass or Tincal; but don't keep it too long in Fusion, lest the Brass should fly away in a Fume.

*Another, for coarse Silver.*

**F**OUR ounces of Silver, three ounces of Brass,  $\frac{1}{4}$  of an ounce of Arsenick, melt this together, and pour it out quick.

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- \* The Calcination of Vitriol is perform'd thus: Put what Quantity you please of green Vitriol into an earthen Pot, unglazed; set the Pot over the Fire, and the Vitriol will dissolve into Water; boil it till the Moisture is consumed, or the Matter turns into a grayish Mass, drawing towards white; this is called White calcined Vitriol. If you calcine this white Vitriol a good while over a strong Fire, it will turn as red as Blood. This is call'd *Colcothar*.

*Another,*

*A good Silver Solder.*

**M**ELT two ounces of Silver, one ounce of Tincal, add to it half an ounce of white Arsenick, pour it out quick, and it is a very good Solder.

*Another.*

**M**ELT one ounce of fine Silver, one ounce of thin Brass; when both are well melted together, then sling one ounce of white Arsenick upon it, let it liquitate, stir it well together, and pour it out quickly.

*A good Solder for Gold.*

**M**ELT Copper and fine Silver, of each one part, fine Gold two parts. Or,

**T**AKE one penny-weight of the same Gold your Work is of, and allay it with three grains of Copper and three grains of Silver.

## The Manner and Way of Soldering GOLD or SILVER.

**B**EAT the Solder thin, and cut it in little Bits or Pallions, then take the Work which is to be soldered, join it together with fine Wire, wet the Joinings with a Pencil with Water, mix'd up with Borax; then lay the Bits or Pallions of Solder upon it, and strew some powdered Borax over it; lay the Work, if it be a Button or some other small Thing, upon a large Coal, and blow with your Blowing Instrument through a large Lamp Flame upon it, for to melt it.

**A**FTER this, you boil the Work either in Alom-Water, or else, in Aqua Fortis, to clear it from the Borax, and then dry it on a Charcoal Fire; then file or turn it; If it is Silver, boil it white in the following Manner.

**T**AKE the Work, lay it on a clear Fire, and when red hot, take it out, and put it by to cool; in the mean while  
sett

set a Copper Sauce-Pan with Water upon the Fire, into which put one part of fine Salt, and one part of Tartar; this boil together, yet not too fierce, to prevent its boiling over; after it is well boiled, lay the Work when it is a little cold, into it, and let it boil about six Minutes; then take it off the Fire, take out the Work, and put it immediately into clean Water; take it out and scratch it well with a Wire Brush, to clear it of the Coat; then repeat this Work over again; Neal it once more, boil it in Tartar and Salt, and proceed as before; then take black burnt Tartar, mix it with a little Water into a Paste, with which rub over the Work; then Neal it on a clear Coal Fire; take it out, and brush the Work well of the burnt Tartar in clean Water; put it once more in the Tartar-Water in which it was boiled, and let it boil four Minutes; then wash it in cold Water, and dry it with a clean Rag, it will be of a white and beautiful Pearl Colour.

*To solder a Ring set with Stones.*

**T**AKE a large Charcoal, put two or three Penny Weights of Silver upon it, melt it with your Blowing Instrument and the Lamp; then, after you have clap't a thin Pallion of Silver Solder betwixt the opening of the Ring, dip it into it; but as soon you see the Pallion run, take off your Ring, or else the Silver will devour it.

*For Soldering.*

**T**AKE the best hard Venice Soap, scrape it as thin as possible, let it dry between two Papers in the Air; then rub it to a Powder, put it in an unglaz'd Pipkin, set it on a gentle Coal Fire, and let it by Degrees fumigate, till it has no moisture at all, then is it right; this Borax you may use for all Manner of Work, and it will do better than the Venice Borax.

*To melt in a Moment several Sorts of Metals, over a Table.*

**T**AKE two ounces of Salt-petre, Tartar one ounce, Sulphur half an ounce, beat it in a Morter to a Powder; then take one ounce of filed Metal, or fine pulverized Oar, mix it well together, put it in a small Crucible, or a hollowed Charcoal, light it with a little Splinter, and it will melt immediately.

*Another*



*Another Manner of doing it.*

**T**AKE one ounce of Saltpetre, half an ounce of Sulphur,  $\frac{1}{4}$  of an ounce of Gun-Powder; grind it well together, and put half of this Powder into a small Crucible, or if you will, into an Egg-shell, then put a Farthing or Sixpence, or any other Metal upon it, and upon that, put the other half of the Powder, press it down with your Finger, then set it on a Stone, light it, and it will melt immediately.

N. B. A gilded Cup, or other Plate, if anointed with Sallet Oil, and this Powder flung upon and lighted, takes off the Gold, and melts it to a Mass.

*To prepare Aurum Fulminans.*

**T**AKE Gold that's refin'd with Antimony, beat it in thin Plates, put it into a Phial or Matrafs, pour Aqua Regis upon it; then set the Phial or Matrafs upon warm Sand, till the Aqua Regis has dissolv'd as much of the Gold as it is able to contain, which you will know when you see the Ebullitions cease; pour your Solution by Inclination into another Glas; and if you see there remains any Gold in the Matrafs, dissolve it as before with a little fresh Aqua Regis; mix your Dissolution, and pour to it six times as much common Water, afterwards drop into this Mixture, by Degrees, the volatile Spirit of *Sal Armoniack*, or Oil of Tartar, and you will see the Gold precipitate to the Bottom of the Glas; let it rest a good while for the Gold to settle, then pour off the Water by Inclination, wash your Powder with warm Water, till it grows insipid, dry it to the Substance of a Paste, then form it in little round Corns, the Bigness of Hempseed, dry them by the Sun; if you put one of them into the Fire; it will fly and disperse with a terrible Noise, and beat about with great Violence.

*To make Aurum Sophisticum, or mimick Gold.*

**T**AKE fine distill'd Verdegrease eight Ounces, Crude Alexandrian Tutty four Ounces, Borax 12 Ounces, Salt-peter one Ounce and a half, pulverize and mix them all together, temper them with Oil, with a wooden Spattle, to the Consistence of a Paste, then put a *German Crucible* in a Wind-Furnace, heat it red hot, and convey your Mass into it with

with a wooden Spattle, by little and little; when all is in, cover it, fill your Furnace with Coals all over the Crucible; let it stand in a fierce Fire and melt; let it cool of itself; then break the Crucible, and you will find at the Bottom a fine *Regulus* like Gold, weighing about four Ounces, out of which you may form and make what you please, it will work as malleable as real Gold.

*Another.*

**T**AKE fine and clear Wire-Copper four ounces; melt it; then sling into it one ounce of *Speltar*, stir it well together with an Iron Spattle; blow the Fire brisk, to bring it in Fusion, but before you pour it out, put in some Borax and it will give it a peculiar Beauty: Then cast it into an Ingot; out of this Ingot you may draw Wire for Chains, and work it in what Form or Shape you please, and after you have filed it, and rubb'd your Work well with Tripoly, then give it the Finishing with a Mixture of one Grain of Tripoly, and six Grains of Flower of Sulphur, which put upon a Piece of Leather, and rub your Work as usual, and it will have a fine Gold Colour.

*Another.*

**T**AKE *Speltar* one ounce, of the finest and softest Copper two ounces; melt the Copper in a Crucible; when melted, sling into it Venice Borax one Grain, and Sal-armoniac one Grain, and lastly sling in the *Speltar*: Pour it into an Ingot, and you will have a fine Gold colour'd Metal.

*To make a curious yellow mix'd Metal, which resembles Gold, and may be drawn into fine Wire.*

**T**AKE eight Ounces of Tartar, put it into a Crucible, and let it Neal by Degrees; then take pulverized dry *Salt-petre*, and sling it on the red hot Tartar, and it will melt into a yellow Matter; take it from the Fire, let it cool, then take clean Copper, put it in Fusion till it is like fair Water, and sling to eight Ounces of Copper the above Matter, give the Crucible a strong reverberatory Heat, till in Fusion, then take the best *Speltar* or *Gofstar Zink* half an Ounce, Tutty and Venice *Salacani* half an Ounce, put it to the melted Copper,

Copper, and presently you will hear a crackling Noise, and see a yellow Fume and Flame ascend; stir this Copper and the other Ingredients well together with an Iron Wire till it is burnt away, let it stand a little in the Flux, and then after you wiped your Ingot with Wax, pour it in, and it will be playable as to be drawn into Wire, and of a high Gold Colour; you may work, form, finish, and colour it as you do other Gold.

*Another Method to make a Metal resembling Gold.*

**T**AKE fine Copper Filings one Pound, fine *Salt-petre* eight Ounces, prepared *Tutty* six Ounces, *Borax* six Ounces, *Hepatic Aloë's* four Ounces; mix all well together, and incorporate it with Linseed Oil into a Mass; put it in a clean Crucible, and cover it a-top, a Finger's Height, with subtil pulverized Venice Glass; lute it well; put it into a Wind-Furnace; fill the same with dead Coals, then put live Coals upon them, and light the Fire from the Top to go downwards; blow it for an Hour long, and give it a fierce Fire; then let it cool of itself; take out the Crucible, break the same, and you will find at the Bottom thereof a very fine *Regulus* like Gold; this you melt again, and add to one Pound two Ounces of *Mercury Sublimate*, and two Ounces of prepared *Tutty*, both clap'd up in red Sealing-Wax; stir it well with a dry Stick; then cast it into a Mould, and make of it what you please.

*Another.*

**T**AKE six ounces of distill'd Verdegrease, grind it fine in a Marble Mortar, eight ounces of prepar'd *Tutty*, four ounces of *Saltpetre*, four ounces of *Borax*; beat it to a coarse Powder; moisten it with Oil of Turneps, and stir it in an earthen Dish all together, till all is well mix'd: Then put a Crucible into a Wind-Furnace, and when red hot, convey the said Mixture into it with a wooden Spattle; cover it; add more Coals, and give a brisk and strong Fire, all over the Crucible. In about half an Hour put a little Stick into it, and search whether the Matter is dissolved, and in Fusion like Water; if so, then it is time to pour it out; but if you find still some Matter remain, you stir it about with your Stick; cover it, and repeat giving it a brisk Fire, till you find it is all dissolv'd: Then pour it out, into a Mortar, or Brass Cone, and you will have a fine Gold-colour'd *Regulus*.

*To silver Copper or Brass.*

**T**AKE fine Silver one ounce, *Sal-gemme* and *Sal-armoniac* of each six ounces, *Glass-Gall* six ounces; beat the Silver thin, and then lay it in one ounce of *Aqua Fortis*, let it dissolve; when dissolved, fling a little Salt into it, and the Silver will settle like a white Calx at the Bottom; then pour off that Water, and put on fresh; repeat it, till the Silver Calx has lost all the Flavour of the *Aqua Fortis*; dry this Silver Calx; then take the above Ingredients and grind them well on a clean Stone; when you have well ground them, mix and grind them and the Silver Calx together, with a little Water, till it is like a thick Paste; put this up in a clean Glass; and when you will silver, take Care that your Metal be filed and brush'd clean; strike it over with the above Matter, and lay it on live Coals; when it has done smoaking then scratch it well, and strike it over again with the Silver Matter; do this three Times successively, and you will have a fine Silvering.

*To silver Copper or Brass.*

**T**AKE fine Silver, dissolve it in *Aqua Fortis*; then add to it the same Quantity of warm Water, as you had *Aqua Fortis*. Take common Salt, fling it in the mixt Waters, and the Silver will precipitate to the Bottom like a Powder; when settled, pour off the mixt Water, and sweeten the Silver Calx, by pouring fresh Water to it, shifting it, till all the Sharpness is gone from it. Then drain off the Water, and let the Silver dry; whereof take a  $\frac{1}{4}$  of an ounce, white calcin'd Tartar one ounce, common Salt half an ounce; beat and mix this well together, and with *Aqua Fortis* grind it upon a Stone; then let it dry, and you have the Powder to silver withal ready. If you will silver; either poor Silver, Copper, or Brass, then rub the Powder after you have moistened it with Water, with a Piece of Cork well in, so long till you see the Execution thereof to your Mind; then lay it on a Coal Fire, till it is red hot; let it cool; then boil it in Water with Tartar and Salt, and after it is boiled, wash it in clean Water.



*To silver Brass in Fire.*

**T**AKE Calx of fine Silver half an ounce, one ounce of Sal-armoniac, three ounces of Salt; mix and grind these well together. When you use it, grind and temper it together with Water, and rub your Brass therewith; Neal it brown; then quench it in Water wherein Tartar has been dissolv'd; scratch it, and finish your Work by polishing it, as you see requisite.

*A Powder to silver Copper or Brass withal, by rubbing it with one's Finger.*

**D**ISSOLVE a little Silver in *Aqua Fortis*, add to it as much Tartar and Sal-armoniac as to make it like a Salve, whereof make little Balls; dry and pulverize them: If you take some of this Powder with your wetted Thumb, and rub it upon Copper or Brass, it will give it the Colour of Silver.

*A Silvering on Copper.*

**D**ISSOLVE fine Silver in *Aqua Fortis*; pour it upon pulverized Tartar, and then draw your *Aqua Fortis* clear off, and there remains a black Matter; with this rub your Copper; then Neal it well and boil it in Tartar and Salt.

*To silver Copper or Brass, with boiling it.*

**T**AKE three ounces of Salt, 26 Leaves of Silver,  $\frac{1}{4}$  of an ounce of Tartar, half an ounce of Alom; this boil in an earthen Panniken, and stir it well together; put what you design to silver, into it; pour Water upon it, and let it boil; after it is well boil'd, scratch-brush it; put it in again and boil it; then scratch it again, and repeat this so often, till it is to your Satisfaction.

*To boil Brass like Silver.*

**T**AKE one part of the Fillings of good Pewter; add to it one part of white Tartar, and mix it together: Then take an unglaz'd Pipkin, put these two Ingredients, and the Brass (which before must be well scratch'd and clean'd) into it, and let it boil.

To

*To silver Copper, Brass, Steel, or Iron, so as not to come off, except it is made red hot.*

**T**AKE Urine which is made in the Morning, cover it, and let it stand a whole Month, and it will foment; put it into a Kettle or earthen Pot, and let it boil; skim it, and when the third Part is evaporated, take to two Pints of Urine one ounce of Tartar, and one ounce of Galiz-stone; put it in, and let it boil once up. This Liquid keep clean; and if you will silver any Metal, take Brick-Dust on a damp woollen Rag, and rub therewith your Iron or other Metal, till it is clear and fine and put it 24 Hours in the prepared Urine; afterwards dry it, and where you design to silver it, rub it over with Quicksilver; you must lay it on thin with an Iron Spatula that has also lain 2 Hours in the Urine; then rub it on with a soft woollen Rag, and it is a fine bright Silvering.

*To silver all Sorts of Metals.*

**T**AKE as much *Aqua Fortis* as you think there is Occasion for in a Glass, and set it on hot Ashes; then put in your Quantity of Silver, which first has been beaten very thin, and cut in little Shreads. When your Silver is dissolv'd, take it from the Ashes, and mix that Liquid with as much White Tartar as to make it like a Dough: If you rub Brass, Copper, or any other Metal over with this, it will be like Silver itself.





## PART II.

Choice Secrets for JEWELLERS, in ENAMELLING, and the Preparing of ENAMEL-Colours; the Art of Painting Portraiture on Enamel'd Plates. Several curious Instructions how to make Artificial Pearls; of DOUBLETs and FOYLES; how to prepare and colour them. The Art of copying Precious Stones, together with other rare Secrets.



THE foregoing Part will, no doubt, give a sufficient Idea, and direct the ingenious Reader in the Management of *Gold* and *Silver*, in all the different Branches specified. We shall in this Second Part present him with several choice Secrets, peculiarly relating to JEWELLERS, and first shew that admirable Branch

## OF ENAMELLING.

*To prepare the Flux for Enamel Colours.*

**T**AKE four ounces of Red Lead, one ounce of well wash'd and clean'd Sea-Sand, melt it together, and pour it into a cold Ingot. Or,

TAKE Pebble one part, prepared as shall be directed; mix one part thereof with five parts of Red Lead.

*Another Sort of Flux, which is very soft.*

**T**AKE one ounce of White Lead,  $\frac{1}{2}$  of an ounce of Red Lead, six Grains of Pebble; heat the Pebbles red hot, and quench them in Urin; repeat this, till you can rub

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rub them to an insensible Powder between your Fingers; then beat them fine, put them with the Ingredients into a clean Crucible; lute it well, and when dry, give it a fierce Fire for half an Hour, or longer; then take it off the Fire, and let it cool of itself; break the Crucible afterwards, and you will find a *Regulus*; which melt again in another clean Crucible, and pour it into a clean Ingot, or a bright Brass Weight Scale, and then it will be fit for Use; beating and grinding it in an Agat Mortar to an insensible Powder. When you mix your Colours therewith, temper as much as you have occasion for, with Oil of Spike.

*A Green Colour.*

**T**AKE Copperas, and Neal it; take of it one part, and four parts of Flux. Or,

**T**AKE Brass, dissolve it in *Aqua Fortis*; then Neal it well; take of this one part, and three parts of Flux.

*Another.*

**T**AKE Copper Plates, and with a Piece of Pumice-Stone rub it over with Water, receive the Water in a Basin or Dish, so long till you have wore it off pretty thin, then let it settle; pour off the Water, and Neal the settling; then take thereof one part, and three parts of Flux; which makes a good and fine Green.

*Dark Green.*

**T**AKE green Enamel two parts, yellow Smalt one eighth part, and six parts of Verditer.

*Yellow Colour.*

**T**AKE fine King's Yellow, Neal it in a Crucible, one part Yellow, and three parts Flux.

*A High Yellow.*

**T**AKE Gold-Yellow Enamel, Vitriol and Flux; grind and temper it as you would have it with Oil of Spike.



*Brimstone Colour.*

**T**AKE calcin'd Naples Yellow one part, three parts of burn'd Lead Yellow, and three parts of Flux.

*A Black Colour.*

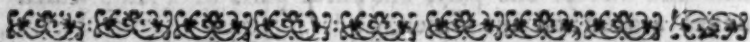
**T**AKE six eight parts of black Enamel, and one eighth part of Scales of Iron of a cleap enamelling Plate: This grind together with Water in an Agat Mortar very fine; draw the Water from it, and dry it upon hot Plates; then grind it with Oil of Spike.

*Another.*

**T**AKE Hungarian Vitriol; boil it over a little Fire, like Borax, and melt it in a new Crucible, three different Times; one part Vitriol, three parts Flux; grind this with Oil of Spike as quick as possible.

*Another.*

**T**AKE Magnesia, Neal it upon a Tile; the blacker it comes off the Fire, the better; one part thereof with three parts of Flux, ground with Oil of Spike.



## Several other FIRE COLOURS for Enamelling,

*A Good Red.*

**T**AKE Hungarian Vitriol; grind it fine, and dry it in the Sun, then Neal it between two Crucibles, well luted, so as to prevent the Air coming to it. Take thereof one part, and two parts and a half of Flux; melt it together, and when you use it, grind it with Oil of Spike.

*Another.*

**T**AKE Roman Vitriol, about the Quantity of a Walnut; grind it in a Stone Mortar very fine; dry it, and then

then Neal it to a brown Colour; take the heavy Lumps, put them in a new glaz'd Pipkin, and pour *Aqua Fortis* upon it; then wash the *Aqua Fortis* from it again, and let it evaporate; take afterwards one part thereof, and three parts of Flux; grind it with Oil of Spike.

*Another.*

**T**AKE Brown Red, or *Caput Mortis* of *Aqua Fortis*, or Paris Red, and a little Flux; grind it fine with Oil of Spike.

*Another.*

**T**AKE Vitriol, let it boil up in a clean Crucible; and when dry, pour a little *Aqua Fortis* and Vinegar to it; Neal it well; after that wash it with clean Water, till it has no Taste; dry it over a Fire; and when dry, Neal it again; then take of this one part, and three parts of Flux.

*Blew Colours.*

**T**AKE fine Smalt, wash it well with clear Water, as fine as possible; put a little Flux to it, and grind it with Oil of Spike.

*Another.*

**T**AKE Ultramarine one part, Flux four parts; grind it with Oil of Spike.

*Another.*

**S**IX ounces of Lead, four ounces of Sand, two ounces of Saffera, two Quarts of Pot-Ashes, and two Quarts of Lead Salt.

SMALT may also be used without the principal Powder, only ground with Oil of Spike.

*Green.*

**T**AKE Verditer, and a little grounded Flux; grind it with Oil of Spike.

*Grass Green.*

**T**AKE Verditer; Neal it in a Crucible, one part of this, and three and a half of Flux.

*Brown Colours.*

**T**AKE *Crocus Martis* one part, Flux two parts, grind it with Oil of Spike.

*Purple Colour.*

**T**AKE one part *Crocus Martis*, one part Smalt, and three parts Flux.

*Another.*

**T**AKE Bloodstone; grind it with Vinegar; when it is fine, wash it clean, and burn it over a Candle on a thin Plate.

*A Hair Colour.*

**T**AKE Umber, Neal it in a Crucible; then take one part thereof, and three parts of Flux; grind it with Oil of Spike.

*Fawn Colour.*

**T**AKE Vitriol, glow it as hot as you possibly can; then take of it one part, and three parts Flux.

*Carnation Colour.*

**T**AKE yellow Oaker, glow it in a Crucible very hot, and after that let it cool, and beat it in an Iron Mortar, and if it is not of a fine Colour, Neal it again; of this one part, and three and a half of Flux.

*A Steel Red for Enamel.*

**T**AKE fine thin beaten Plates of Steel, cut them into small Shreads; put them into a Viol with *Aqua Fortis*, and when reduced to a Calx over a slow Fire, then Neal it; of this one part, and three parts of Flux.

Of

Of the ART of PAINTING ON ENAMEL.

**T**HE Ancients that laboured in this noble Art, were unacquainted with the Beauties the Moderns have discovered, particularly in the Art of compounding Colours for representing Portraits and History; the fine Performances in those Particulars are the Admiration of every curious Beholder: Besides their peculiar Beauty and Lustre, they have the Pre-eminence before all other Paintings, in that they are not subject to the Injury of the Air or Weather, as most all other Paintings, either in Oil or Water-Colours are; and unless being rubb'd or scratch'd with any Thing harder then itself, the Colours will retain their Beauty for Ages, and be as fine and bright as when first done.

THIS curious Art cannot be effected without Fire, which always must be Reverberatory, or in a Furnace, so artfully contriv'd that the Fire may play all over the Muffle that covers your Work; but to explain this more fully: Take the half of a large Crucible, namely one that is split down lengthways, but as thin as possible you can get: When your Reverberatory is building, let the Mouth Part of the Crucible, the split Side downwards, be placed fronting the Mouth of the Furnace, and be fixt in such a Manner, that the Furnace-Fire may not play into it, nor the Ashes drop upon your Work.

YOUR Furnace may be either round or square; let it be of Iron or Earth, it is no Matter which; only let there be so much room in the Inside as will contain the split Crucible or Muffle with a good Charcoal Fire round about, to cover it: You must have a Slice or Iron Plate to put your Work upon, which, with a pair of Tongs, you convey into the Furnace, and bring it out again.

THE Metals fittest to enamel upon are Gold, Silver, and Copper; but the best Work is perform'd on Gold, for Silver makes the white Enamel appear of a yellowish Hue; and Copper is apt to scale, whereby the Enamel is subject to break in Pieces; besides, the Colours loose a great Deal of their Charms and Lustre to what they appear upon Gold. And the Gold, used for this Purpose, should be the finest,  
else



else the Impurities of a bad Allay will have the same Effect in the Enamel Colours as the Silver or Copper.

YOUR Plate, of whatever Metal it be, must be very thin, raised in the Nature of a Convex; both that and the Concave Side are laid over with white Enamel; that on the Convex Side whereon you Paint must be lay'd on a small Matter thicker than the other. You must observe that the white Enamel which you lay on the Convex, must be ground with fair Water in an Agat Mortar, and with an Agat Pestle till it be fit for Use: The Enamel for the other Side must be tempered with Water wherein you have before steep'd some Quince Kernels.

As to the Enamel Colours which you paint with, you must take great care that they be equally tempered or your Work will be spoil'd; if one be softer than the other, when your Work comes into the Furnace and to be hot, the soft Colour will intermix with the hard, so as to deface your Work intirely: This may serve to caution you to make tryal upon a white enamel'd Plate for that Purpose; of all your Enamels, before you begin your work; Experience will direct you further.

TAKE particular Care that not the least Dirt imaginable may come to your Colours while you are either painting or grinding them; for the least Speck thereof, when it is workt up with it, and when the Work comes to be put into the Reverberatory to be red hot, wherever the Dirt is, will leave a Hole, and so deface your Work.

AFTER you have prepared your Plate with a white Enamel, and ready to paint upon, apply your Colours on an Ivory Pallat or a Piece of Glais in a just Order, as in Limning, and first deliniat your Design with a dark Red, made out of *Caput Mortus* or *Crocus Martis*, ground with Oil of Spike; put the Piece in the Muffle, and with a reverberatory Fire, as before directed, fix that Colour; and then proceed to Painting, remembring to delute the thick and opaque Enamel Colours with Oil of Spike; and the transparent ones with fair Water: By mixing blew and yellow Enamel-Colour you have a fair green; blew and red, a Violet; red and white, a Rose Colour; and so of other Colours.

WE shall here set down several other Receipts for preparing Enamel Colours to the greatest Perfection, which will not only be fit in beautifying and adorning of Gold; but also for Portraiture or Painting on Enamel.

*To prepare the principal Matter for Enamel-Colours.*

**T**AKE Lead 15 pound, Plate-Tin Ashes 16 pound; mix and calcine these as directed in the First Part. After you have calcined your Lead and Tin, searce the Calx, and put them into an earthen Pot fill'd with Water; set it over a Fire, and let it boil a little, after which take it off, pour the Water into another Vessel, which will carry the more subtil Calx along with it; repeat this so long till you can subtilize no more of the Calx, and the Water comes off clear without any Mixture. What gross Part remains in the Pot, calcine as before, and this repeat so often till you can draw off no more of the subtil Matter. Then pour the Waters out of all your Receivers into one that is larger, and evaporate it on a slow Fire, least by a fierce one the Calx should founder or settle to the Bottom, but continue more fine and subtil then when first calcined.

Of this Calx take 12 pound, Frit of white Sand beaten and searced 12 pound, Saltpetre purified 12 Pound, Salt of Tartar purified \* and searced two ounces. Put these Powders all together in a Pot, place it into a Glass-House Furnace for 10 or 12 Hours to digest and purify. Then take and reduce it to an impalpable Powder; keep it in a close dry Place for Use. Thus is your first or principal Matter for Enamel-Colours prepared.

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\* To purify Salt of Tartar, Calcine Tartar of red Wine in an Earthen Pot, till it comes black; continue the Fire till it changes to a White, Then put it into an Earthen Pan, glaz'd; fill the Pan with clear Water, and boil it over a gentle Fire, so that in four Hours the Water may evaporate the fourth Part; then take it off the Fire, and after the Water is settled and cold; pour it off by Inclination, into a clean glaz'd Pan, and you will have a strong Lee. Then pour clean Water on the Feces, and let them boil as before: This repeat, till the Water becomes insipid; Then filter the Lees; put them in Glass Bodies upon the Ashes in a gentle Heat to evaporate, and at the Bottom there will remain a very white Salt. Dissolve this Salt again in fair Water, and let it stand two Days, for the Feces to settle; then filter it, and evaporate it at a gentle Fire as before, and you will have a Salt whiter then the former; repeat this three or four times, and your Salt will be whiter than Snow itself.

*To make Enamel of a Milk white Colour.*

**T**AKE three pound of the fore-mentioned principal Powder, and 24 Grains of *Magnesi* prepared \*, Arsenick two pound, put this together into a melting Pot to melt and to purify over a fierce Fire: When the Matter is thus melted, throw it out of the Pot into fair Water, and having afterwards dry'd it, melt it again as before; do this for the third Time, changing the Water: When you have thus purified it, and find the White answer your Intent, it is well; but in Case it has still a Tincture of a greenish Hue, add a little more *Magnesi*, and in melting it over again it will become as white as Milk, and be fit to enamel with upon Gold or other Metals: Take it off the Fire, make it in Cakes, and preserve it for Use.

*A Turcoise blue Enamel.*

**T**AKE of the principal Matter or Powder three pound, in a white glaz'd Pot, melt and purify it; then cast it into Water; when dry, put it again into a Pot, and being melted over again, add to it at four times this Composition: Scales of Copper thrice calcined † two ounces and a half, prepared Zaffer 43 Grains, of prepared *Magnesi* 24 Grains, Stone blew two ounces; mix and reduce these to a very fine Powder; stir the Matter very well with an Iron Rod, for the Powders to incorporate. When your Matter is thus ting'd, observe well whether your Colour answers your Intent before you empty the Pot: If you perceive the Tinging-powders are too predominant, add more of the principal Powders; and if too faint, add more of the Tinging-powder. Your own Judgment must direct you in the Management of this Preparation.

\* The Preparation of the *Magnesi* is thus: Put some Pieces in an Iron Ladle into a Reverberatory Fire; and when it begins to whiten, sprinkle it with good Vinegar, after which beat it, and wash it whilst hot; then dry it, and reduce it into a Powder.

† To calcine Copper Scales, such as come from the Hammer of Brasiers or Copper Smiths: Wash them from their foulness, put them into a Crucible, place it in the Mouth of a reverberatory Furnace for four Days; after which let them cool, then pound, grind, and searce them. This Powder put a second time into the Furnace, to reverberate four Days longer; proceed as before, and after it has stood again the third time for four Days, reduce it into Powder, and it will be fit for the Use design'd for.

*A fine*

*A fine blew Enamel.*

**T**AKE two pound of the principal Powder, purified, 1 Ounce of prepared Zaffer, or of Indigo-Blew; 22 Grains of Copper thrice calcin'd; mix and reduce these to a fine Powder, put it into a white glaz'd Pot: When the Metal is melted, cast it into Water; then dry it, and put it into the Pot again; let it stand upon the Fire, till it is well incorporated. Take it off, make it into Cakes, and keep it for Use.

*A Green Enamel.*

**T**AKE two pound of the principal Powder, purified; one ounce of Copper Scales thrice refin'd, 24 Grains of Scales of Iron, Copperas two ounces, yellow Arsenick one ounce; mix and reduce these to an impalpable Powder, and at three several times or Portions, fling it into the principal Matter, stirring the Metal so as to tinge it equally. When the Colour is to your liking, let it stand for a while in the Fire, to incorporate thoroughly; then take it off, and you will have a delicate Green.

*Another.*

**T**AKE \* *Ferretto of Spain* two ounces, 48 Grains of *Crocus Martis* prepar'd with Vinegar, yellow Arsenick two ounces; pulverize and mix this well, and put it into a white glaz'd Pot, set it in the Furnace to melt, and refine the Matter; after which cast it into Water, and when dry'd, again into the Pot: When melted, observe whether the Colour is to your liking: If so, let it stand for some time longer to refine. If you find the Colour too faint, add more of the tinging Powder.

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\* *Ferretto of Spain* is thus prepared: Stratify thin Plates of Copper with Vitriol, in a Crucible; put it in the Mouth of a Glass Furnace, for three Days; then take it out, and add to the Copper new Rows or Layers of Vitriol, stratifying them as before; Then put the Crucible again in the same Place of the Furnace: This repeat six Times successively, and you will have an excellent *Ferretto*; which beat to Powder, and it will tinge Glass of an extraordinary beautiful Colour.

*A Black.*



*A Black Enamel.*

**T**AKE of the principal Powder two pound, prepar'd Zaffer one ounce, and prepar'd *Magnesi* one ounce; pulverize and mix this, and proceed as directed in the preceding Colours.

*Another.*

**O**F the principal Powder three pound, Zaffer one ounce, *Crocus Martis* one ounce, *Feretto of Spain* one ounce; pound and mix it, and proceed as directed before.

*A Velvet Black Enamel.*

**O**F the principal Powder two pound, Red Tartar two ounces, prepar'd *Magnesi* one ounce; pulverize this, and put it into a glaz'd Pot, bigger than ordinary, because the Metal will raise; for the rest, proceed as directed before.

*A Purple Colour Enamel.*

**O**F the principal Powder two pound, prepar'd *Magnesi* one ounce, Indigo-Blew half an ounce; proceed as above.

*Another.*

**P**RINCIPAL Powder three pound, prepar'd *Magnesi* one ounce and a half, of twice calcin'd Scales of Copper three ounces, Stone-Blew one ounce; pulverize, and proceed as directed.

*A Violet Enamel.*

**O**F the principal Powder three pound, prepar'd *Magnesi* one ounce, thrice calcin'd Copper Scales 24 Grains, Terra-Vert one ounce; pulverize and mix this all together, and proceed as before directed.

*A Yellow Enamel.*

**O**F the principal Powder three pound, Tartar one ounce and a half, prepar'd *Magnesi* 36 Grains, yellow Orpiment two ounces, Arsenick one ounce; pulverize it, and proceed as before directed.

*An*

*An excellent Red Enamel, of a very Splendid Ruby Colour.*

**T**HIS Enamel is of a surprizing Beauty, and its Lustre equals that of a real Ruby. To prepare this, take equal Quantities of *Magnesi* of *Piedmont*, and *Saltpetre*; let them reverberate and calcine in an Earthen Pot in a Furnace for 24 Hours; take it then off, and wash it well in warm Water, to separate the *Saltpetre*; dry it well, and the Mass will be of a red Colour: To this add an equal Quantity of *Sal-armoniac*; grind this on a Marble with distill'd Vinegar, as Painters do their Colours; dry it, and pulverize it: Then put it into a strong Matraiss, let it sublimate for 12 Hours; break off the Neck of your Matraiss, and mix all the volatile and fixed Parts together, adding the same Quantity of *Sal armoniac* as there are Flowers, and take care to weigh them before the Composition; grind, pulverize and sublimate as before, repeating this until your *Magnesi* remains fusible at the Bottom of the Matraiss: This preserve to tinge your Crystal with; and according to your liking, add either a greater or lesser Quantity of the *Magnesi*, or else of the Crystal, till you have brought it to its Degree of Perfection.

*A Rose Colour'd Enamel.*

**T**AKE five Pound of Crystal ground, melt it in a glaz'd Pot, add at four different times two ounces and a half of thrice calcin'd Copper; stir the Metal every time, then pour into it *Crocus Martis* and *Magnesi*, prepared as directed; let it stand for six Hours to cleanse, and if the Colour is too light, add a little more *Crocus Martis*, till it be of a fine Rose Colour.

OBSERVE that all the Colours, which are not pure Enamel, must be incorporated with the Crystalline Matter, to the End they may vitrify the better, which else they would not easily do. Most Workmen make use of *Rocailli*; but that does not answer the Purpose so well as Crystal ground.

*A fine Purple.*

**T**AKE half an ounce of fine Gold; Neal it, and beat it in very thin Plates; dissolve this in four ounces of *Aqua Fortis*, regulated with *Sal-armoniac*, or old strong Salt; put it into a Glass Cucurbit, which set on warm Ashes or Sand, to

to dissolve; put to it a small Matter of Saltpetre; when all is dissolved, drop two or three Drops of Oil of Tartar into it, and stop the Cucurbit close, to prevent its boiling over: Then put in some more Drops of Oil, and repeat this so long, till it ebullates or boils no more. After this, put some lukewarm Rain-Water to it, and let it stand for some Time, and a Powder will settle at the Bottom of the Cucurbit; then pour off the Water leisurely into an earthen or glazed Receiver; put more fresh Water to the Settlement, and repeat this till the Water comes off clear, and free from the Sharpness of the *Aqua Fortis*. When the Powder is settled, and all the Water pour'd from it, then put it upon a Piece of whited brown Paper, to separate it from the rest of the Water, and dry it on a warm Tile, or in the Sun. To one part of this Powder, add six parts of the principal Powder; grind it with Oil of Spike, and it will make a good Purple.

*A good Red Enamel Colour.*

**T**AKE clean Hungarian Vitriol, put it into a Copper Cup, hold it over a Fire, and stir it with a Silver or Copper Wire, till it is reduc'd to a white Powder; this burn upon a hot Tile, on which let it cool of itself; then wash it with Rain-Water, and when settled, pour off that, and put fresh Water on, and thus repeat it several Times.

BUT some Artists, instead of washing this Powder, boil it in fair Water, and think this Method better then that of washing. With this Powder you tinge the principal Matter to what Height you would have your Colour.

*Another good Red Enamel.*

**D**ISSOLVE Vitriol in an Earthen Pan, and it will fix and shoot at the Sides thereof into Crystals; which take and burn over a gentle Fire between two Crucibles well luted: When thus you have burnt it to a Powder, take and boil it in clean Water; and when done, dry it; of this take one part, of the principal Powder three parts, and of transparent yellow one and one eighth part.

*Another.*

**P**UT Vitriol into a Crucible, pour a little *Aqua Fortis* upon it, and Neal it gently; then put it in a clean Earthen Pipkin, pour clean Water upon it, and boil it one Hour; then

then pour off that, and put fresh Water upon it; wash it, and when settled, dry it; Neal it once more, and it is fit for Use. Of this Powder take two parts, and of the principal Powder or Flux, three parts.

*A Flux for Red Enamel.*

**T**AKE of Red Lead four ounces, white scouring Sand one ounce; melt it, and pour it into an Iron Mortar.

*Some General Observations.*

**B**EFORE we proceed to another Subject; we will conclude this Article with a few Observations and general Rules, for the more easy apprehending of what has been said already.

You may observe, That Gold is the most proper Metal to enamel upon: That every Colour, except a Violet or Purple, receives an additional Beauty from it; to what it does from Silver or Copper: That it is most agreeable to enrich Gold with such beautiful Colours, since they raise an agreeable Admiration in the Beholder, when a skilful Artist places them in due Order.

THE Ancients only painted in black and white, with something of a Carnation or Flesh Colour; in Success of Time they indeed made some few Improvements, but all their Enamel Colours were equally alike on Gold, Silver, or Copper; every one transparent, and every Colour wrought by itself. But since the Modern Artists have found out to Enamel with opaque Colours, and to compound them in such a Manner as to shade or heighten the Painting therewith; in the same Manner as is done in Miniature or Oil Painting, this Art has gain'd the Præeminence in small Pourtraitures; it having the Advantage of a natural and lasting Lustre, which is never tarnish'd nor subject to decay.

THE purple colour'd Enamel agrees best upon Silver, from which it receives an agreeable Beauty; so doth the Egmarine, Azure and Green: All other Colours, as well clear as opaque, disagree therewith: Copper suits with all thick Enamels, but is unfit for that which is clear.

You must observe to make choice of good, hard, and lasting Enamel: The soft is commonly full of Lead, which is apt to change the Colours, and makes them look sullied and foul;



but if you follow our Prescriptions, you will meet with no such Inconveniences.

REMEMBER when you lay on your white Enamel on either Gold, Silver, or Copper, to dilute it with Water of Quince Kernels, as has been directed; your clear Enamel Colours mix only with fair Water; and the opaque, when mix'd with Flux or the principal Powder, dilute with Oil of Spike.

BE careful not to keep your Work too long in the Fire, but take it often out, to see when it has the proper Glazing, and then it is finish'd.

BEFORE you use your Enamels, give it a little Preparation: The best approv'd by Goldsmiths is, to take the Enamel, and after you have ground it to a fine Powder, pour on it a little *Aqua Fortis*, and afterwards purify and refine it in a small Glass Cucurbit; then wash it several times in fair Water; dry it, and lay it up carefully to keep it from Dust: When you use it, grind as much as you have occasion for, with fair Water, in an Agat Mortar; thus you do with all your clear and transparent Enamels, and by this Means you will have all Things in Readiness to go on in your Work with Pleasure.

ALL opaque Colours that will stand the Fire, are fit to be used in painting Enamel; and the ingenious Artift will not be at a great Loss, but in searching after them will meet with several Colours not yet discover'd; as it frequently happens to those who try Experiments, and are in Pursuit of new Discoveries, in this as in any other Art.



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## Of Artificial PEARLS.

**I**T will not be improper to treat in this Place on this Subject, as it is a Branch relating to Jewellers.

THE Ancients, who did write about the several Sorts of Precious Stones, did range Pearls among the Jewels of the first Class; they having at all Times been in high Esteem, and have been eagerly sought for, particularly for the Ornament of Ladies.

THE Oriental Pearls are the finest, on Account of their Largeness, Colour, and Beauty; being of a Silver White; whereas the Occidental or Western Pearls seldom exceed the Colour of Milk. The best Pearls are brought from the *Persian Gulf*, above the Isle of *Ormus*, *Bassora*. They are found in *Europe* both in salt and fresh Waters; *Scotland*, *Silesia*, *Bohemia* and *Frisia*, produce very fine ones; tho' those of the latter Country are but very small.

ART, which is always busy to mimick Nature, has not been idle to bring counterfeit Pearls to the greatest Perfection; they are imitated so near, that a naked Eye cannot distinguish them from the Pearls of the first Class, or the real ones, and by this Means the wearing of Pearls is become a universal Fashion.

WE shall here present the Curious with several Receipts how to counterfeit Pearls in the best Manner, and after a Method both easy and satisfactory, so as to render his Labour pleasant and delightful, and to answer his Expectation.

### *To imitate fine ORIENTAL PEARLS.*

**T**AKE of thrice distill'd Vinegar two pound, Venice Turpentine one pound; mix it together into a Mass and put it into a Cucurbit; fit a Head and Receiver to it, and after you have luted the Joints, set it, when dry, on a Sand Furnace, to still the Vinegar from it; don't give it too much Heat, least the Stuff should swell up.

AFTER this, put the Vinegar into another Glass Cucurbit, in which there is a Quantity of Seed Pearl, wrapt in a Piece of thin Silk, but so as not to touch the Vinegar; put a Cover or Head upon the Cucurbit; lute it well, and put it in *Bal. Mariæ*, where you may let it remain a Fortnight. The Heat of the Balneum will raise the Fumes of the Vinegar, and they will soften the Pearls in the Silk, and bring them to the Consistence of a Paste; which being done, take them out, and mould them in what Bigness, Shape and Form you please: Your Mould must be of fine Silver, gilded the Inside; you must also refrain from touching the Paste with your Fingers, but use Silver gilded Utensils, with which fill your Moulds: When you have moulded them, bore them through with a Hog's Bristle, or Gold Wire, and let them dry a little; then thread them again on a Gold Wire, and put them in a Glass; close it up, and set them in the Sun to dry; after they are thorough dry, put them into a Glass Matrafs, in a Stream of running Water and leave 'em there 20 Days; by that Time they will contract the natural Hardness and Solidity. Then take them out of the Matrafs, and hang them in \* Mercury-Water, where they will moisten, swell, and assume their Oriental Beauty; after which shift them into a Matrafs, Hermetically closed up, to prevent any Water coming to them, and let it down into a Well, to continue there about eight Days; then draw the Matrafs up, and in opening it, you will find Pearls exactly resembling Oriental ones. This Method is very excellent, and well worth the Trouble, since by experimenting so fine a Secret one will have the Satisfaction of seeing the Performance answer the Direction above Expectation.

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\* Mercury-Water is thus prepar'd: Take Plate-Tin of Cornwall, calcine it, and let the Calx be pure and fine; then with one ounce of the Calx, and two ounces of prepared Mercury, make an Amalgamate; wash it with fair Water, till the Water remains insipid and clear; then dry the Amalgamate thoroughly, put it into a Matrafs over a Furnace, giving it such a Heat as is requisite for Sublimation. When the Matter is well sublimated, take off the Matrafs, and let it cool. Take out that Sublimate, add one ounce of Venice Sublimate to it, and grind it together on a Marble; put this into another Matrafs, close it well, and set it upside down in a Pail of Water; and the whole Mass will resolve itself in a little Time into Mercury-Water: This done, filter it into a Glass Receiver, set it on a gentle Ash-Fire to coagulate, and it will turn into a Crystalline Substance: This beat in a Glass Mortar with a Glass Pestle to a fine Powder, searce it through a fine Sieve, and put it into a Matrafs, stop it close up, and place it in *Bal. Mariæ*; there let it remain, till it resolves again into Water; which is the Mercury-Water, fit for the above mentioned Use.

*Another Way to make Artificial Pearls.*

**T**AKE Oriental Seed Pearl, reduce them into a fine Powder on a Marble, then dissolve them in Mercury-Water, or clarified Juice of Lemons. To make the more dispatch, set them in a Cucurbit on warm Ashes, and you will see presently a Cream arise at the Top, which take off immediately: Take the Dissolution off the Fire, and when settled, pour off the Liquid in another Glass, and save it. You will have the Pearl-Paste at the Bottom, with which fill your Silver gilded Moulds, and so put them by for 24 Hours: Then boar them through with a Bristle; close up the Moulds in Barley Dough, and put it in an Oven to bake, and when about half bak'd, draw it out, take out your Pearls, and steep them in the Liquid you sav'd before, putting them in and out several times; then close them up in their Moulds, and bake them again with the like Dough; but let it remain in the Oven till it is almost burnt, before you draw it out: After you have taken your Pearls out of their Moulds, string them on one or more Gold or Silver Threads, and steep them in Mercury-Water for about a Fortnight; after which Time take and dry them by the Sun, in a well closed Glass, and you will have very fine and bright Pearls.

*Another Way.*

**D**ISSOLVE very fine pulverized Oriental Pearls in Alom-Water; when the Dissolution is settled, pour off the Water, and wash the Paste that's settled, first in distill'd Waters, then in Bean-Water, and afterwards set it in *Bal. Mariae* or Horse Dung, to digest for a Fortnight; this done, take out your Glass, and the Matter being come to the Consistence of a Paste, mould it as you have been directed before; boar and string the Pearls on a Silver Thread, and hang them in a well-closed-up Glass Limbeck, to prevent the Air coming to them: Thus dried, wrap every one up in Leaves of Silver, then split a Barbel, and close them up in the Belly thereof; make a Dough of Barley Meal, and bake the Fish, as you do a Batch of Bread; then draw him, take out your Pearls, and dry them in a closed-up Glass in the Sun.

To give them a Transparency and Splendour, dip them in Mercury-Water, or instead thereof, take the Herb *Gratuli* squeeze'd in Water; put therein six ounces of Seed Pearl, one



ounce of Saltpetre, one ounce of Roch-Alom, one ounce of Litharge of Silver; the whole being dissolv'd, heat first the Pearls, and then dip them in this Dissolution to cool; repeat this about six times running.

If your Pearls should not have their natural Hardness, then take two ounces of *Calamy*, or *Lapis Calaminaris* in impalpable Powder; add to this two ounces of Oil of Vitriol, and two ounces of the Water of the Whites of Eggs; put it together into a Retort, lute a Receiver to it, and you will still a fair Water, with which, and some fine Barley Flower, make a Paste, in which coffin your Pearls, and bake them as before; thus they will become exceeding hard.

*Another Method.*

**T**AKE Chalk, well purified and cleansed from all grossness and Sand; of this make a Paste, and form thereof Pearls, in a Mould for that Purpose; pierce them through with a Bristle, and let them dry in the Sun, or in an Oven; then string them on a Silver Thread, colour them lightly over with Boli-Armoniac deluted in the Water of the White of Eggs, and drench them with a Pencil and fair Water; lay them over with Leaf Silver, and put them under a Glass in the Sun to dry; when dry, polish them with a Wolf's Tooth.

To give them the true Colour, make a Glue of Vellum Shavings thus: After you have wash'd them in warm Water, boil them in fair Water, in a new earthen Pot or Pipkin, to some thickness, and then strain it through a Cloath. When you will use it, warm it first, and dip your String of Pearls into it, but let there be an Interval between each Pearl, not to touch one another; this will give your Pearls a natural Lustre.

*To form large Pearls out of small ones, as directed by Korndörffer.*

**T**AKE of Mercurial Water 14 Ounces; put two ounces of Sulph. Solis into a low Matrafs, pour the Mercurial Water upon it, and let it dissolve and extract: Then take of the whitest small Pearls 20 ounces, put them into a proper Matrafs, and pour the said Water upon it. The Pearls will by Degrees resolve, and at last turn to a clear Calx, much like resolved Silver Calx; Pour off the Mercurial Water; boil  
the

the Calx well out, and dry it; then put it into a clean Crucible by itself; and melt and cast it into what form you please. When cold, polish it in the same Manner as you do Gems or Crystals, and you will have your Work of the Consistence and Beauty of the finest and clearest Oriental Pearl.

*To make out of small Pearls a fine Necklace of large ones,*

**T**AKE small Oriental Pearls, as many as you will, put them into Mercurial Water 15 Days and Nights together, and they will turn soft, like a PASTE; then have a Pearl Mould, made of Silver; into this convey the PASTE by a Silver Spatel or such like Implement; but you must not touch the PASTE with your Fingers, and be very careful to have every Thing nice and clean about this Work: When it is in the Mould, let it dry therein; boar a Hole with a Silver Wire thro' it, and let it stick thereon till you have more, but take care they don't touch one another; then have a Glass wherein you may fix, as upon a Pair of Stands, your Wires with Pearls; put them well closed up in the Sun to harden, and when you find them hard enough, put them into a Matrafs; lute the Neck thereof very close, and sink it in running Spring Water for 20 Days, in which time they contract their natural Colour.

*To clean Pearls, when of a foul Colour.*

**T**AKE Pigeons Dung, moisten it with Alom-Water, to the Consistence of a PASTE; this put into a Glass, big enough to hold four times the Quantity; put into this your yellow-colour'd or foul Pearls, so that they may be cover'd all over, and set them in a warm Place, behind an Oven; let them stand for a Month; then take them out, fling them into fresh cold Alom-Water, and dry them carefully, and your Pearls will become fine and white: If you repeat the Operation once or twice, they will be done to a greater Perfection.

*To Blanch and Cleanse Pearls.*

**F**IRST soak and cleanse them in Bran-Water; then in Milk warm Water, and last of all steep them in Mercury-Water: Then string and hang them in a Glass; close it well, and set them in the Sun to dry.

THE Bran-Water is made thus: Boil two good handfuls of Wheaten Bran in a Quart of Water, till all the Strength of the

Bran is drawn out, which use thus: Take a new glaz'd earthen Pan, in which put your Pearls on a String, and pour the third part of the Bran-Water upon it; when they have soak'd, and the Water just warm, rub your Pearls gently with your Hands, to cleanse them the better, and continue this till the Water is cold; then throw off that, and pour on another third part of the Bran-Water that's boiling; proceed with this as you did before, and when cold, throw it away, and pour on the Remainder of the Water, still proceeding as before; after this, heat fair Water, and pour it on your Pearls, to refresh them, and to wash away the Remains of the Bran, by shifting them, and pouring on fresh warm Water; This do thrice, without handling your Pearls; then lay them on a Sheet of clean white Paper; and dry them in a Shade; then dip them into Mercury-Water, to bring them to Perfection.

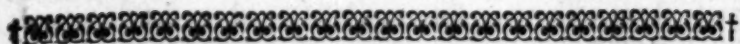
*Other Methods us'd in Blanching of Pearls.*

**P**OUND Alabaster to an impalpable Powder, rub the Pearls therewith very gently; this will not only cleanse them, but if you let them remain in this Powder 24 Hours afterwards, they will still be the better for it. White Coral has the same Effect, used in the like Manner.

**TARTAR** calcin'd white, and divested of all its Moisture, is very good for the same Purpose.

**SALT** dissolv'd, filter'd, coagulated, well dried and ground, is as effectual as any of the former Things, for cleansing of Pearl, by rubbing them therewith; and if afterwards you will lay them up in some coarse ground Miller, it will contribute to their natural Brightness.





## Of DOUBLETS.

**D**OUBLETs being much in Vogue, and the Lapidaries arrived to such a Perfection in the making of them, that they often deceive even tolerable Judges: I shall, for the Sake of such as are unacquainted with the Secrets thereof, set down some Instructions, how they are made; and also how they may be known and distinguish'd from real Gems.

**T**AKE two Drams of clear Mastick; and of the finest and clearest *Venetian* or *Cyprian* Turpentine 16 Drams; dissolve this together in a Silver or Brass Spoon: If you find there is too much Turpentine, then add a little more Mastick to it, to bring it to a right Temper. Then take what Colour you please, as *Florentine* Lake, Dragon's Blood, distill'd Verdegrease, or what Colour else you design, for representing a particular Stone; grind each by itself, in the nicest Manner you possibly can, and mix each apart with the Mixture of Mastick and Turpentine, which you ought to have ready by you; and you will find the *Florentine* Lake to imitate the Colour of a Ruby, the Dragon's Blood that of a Hyacinth, and the Verdegrease the Colour of an Emerald. But in case you would have your Colours, as it were, distilled, then get a little Box, made of Lime-Tree, in the Shape of an Egg or Acorn, as represented in Plate II. Fig. 2.

**T**HIS Box must be turned at the Bottom as thin as possible, so that the Light may be seen through it. Then make a Quantity of any one of the abovesaid Colours, mix'd with the Mixture of Mastick and Turpentine, and put it into that little Box, hung over a gentle glowing coal Fire, or in Summer-time in the Heat of the Sun, where the Colour will distil through very fine: Scrape and put this in little Boxes of Ivory, to preserve it from Dust, for your use. It is necessary to have to every different Colour such a different wooden Box.

**W**HEN the Colours are ready, take your Crystals (first ground exactly to fit upon one another) and make your Colours and Stone of an equal Warmth; lay your Colour with a fine Hair Pencil on the Sides of the Crystals that are to be join'd together;



ther; then clap them again each other as nimble as possible; press them with your Fingers close together; let them cool; and it is done.

*How to know a Doublet from a natural Stone.*

**T**AKE a Stone, in Case you are dubious about it, and look upon it edge-ways against the Light, and if it is a Doublet, you will presently see the clear Crystal, or the Glass, and so find out the Imposter.

*The Crystal Glue of Milan.*

**I**S Nothing else but Grains of Mastick, squeezed out by Degrees over a Charcoal Fire, and like a clear Turpentine. The Pieces which are to be glued together, are first warm'd over a Coal Fire, then the Mastick is put on a Point of a Bodkin and warm'd; when both are of an equal warmth, wipe your Crystal or Stone over with it, clap them upon one another, and press them together; what comes out about the Sides, scrape as soon as it is dry, with a Knife. This withstands as well cold as hot Water, except a fierce Fire.

*Some Remarks on DOUBLETs.*

**W**E must know that all falsified Jewels are made, either of a Saphir, or two Crystals, by putting a Foyl between them, and cementing 'em together, as has been mentioned before, with Mastick. These mimick'd Stones may easily be discern'd, by taking one of them between the two Nails of your Thumbs, and holding 'em against the Light, directing your Eye towards the Middle of the Stone; if the two outer Parts appear white, and the Middle of a different Colour, you may conclude the Stone to be false and made thus by Art.





A Peremptory Instruction concerning the FOYLES  
or LEAVES which are laid under PRECIOUS  
STONES.

**I**T is customary to place thin Leaves of Metal under Precious Stones, in order to make them look transparent, and to give them an agreeable different Colour, either deep or pale: Thus if you want a Stone to be of a pale Colour, put a Foyle of that Colour under it; again, if you would have it deep, then lay a dark one under it: Besides, as the Transparency of Gems discovers the Bottom of the Ring they are set in, Artificers have found out these Means, to give the Stone an additional Beauty, which without these Helps it would be depriv'd of.

THESE Foyles are made, either of Copper, Gold, or Gold and Silver together: We shall first speak of such as are made of Copper only, and are generally known by the Name of *Norimberg* or *German Foyles*.

Buy the thinnest Copper Plates you can get, because the thinner they are, the less Trouble they will give you in reducing them to a finer Substance: Beat these Plates gently upon a well polish'd Anvil, with a polish'd Hammer, as thin as possible: But before you go about this Work, take two Iron Plates, about six Inches long, and as wide, and no thicker then Writing-Paper; bend them so as to fit one in the other; between these neal the Copper you design to hammer for the Foyles, to prevent the Ashes or other Filthiness coming to them: Put your Copper Foyles between these bended Irons, lay them in the Fire, and let them neal: Then, taking them out, shake the Ashes from them, and hammer them, till cool: Take then your Foyles to the Anvil, and beat them till they are very thin; and whilst you beat one Number, put in another between the Irons to neal: This you may repeat eight times, till they are as thin as the Work requires. You must have a Pipkin with Water at hand, in which put Tartar and Salt, of one as much as the other: This boil, put the Foyles in, and stir them continually, till by boiling they become white: Then take them from the Fire, wash them in clean Water, dry them with

with a clean fine Rag, and give them another hammering on the Anvil, till they are fit for your Purpose.

*N. B.* CARE must be taken in the Management of this Work, not to give the Foyles too much Heat, to prevent their melting; neither must they be too long boil'd, for fear of attracting too much Salt.

*How to polish the FOYLES.*

**T**AKE a Plate of the best Copper, one Foot long, and about five or six Inches wide, polish'd to the greatest Perfection: This bend to a long Convex; fasten it upon a half Roll, and fix it to a Bench or Table; then take some Chalk, wash'd as clean as possible, and filter'd through a fine linnen Cloath so often till you think it cannot be finer; and having laid some thereof on the Roll, and wetted the Copper all over, lay your Foyles upon it, and with a Polish-Stone and the Chalk, polish your Foyles till they are as bright as a looking Glass; and when so, dry them between a fine Rag, and lay them up, secure from Dust. I shall now shew how these Foyles are colour'd, but first give a short Description of the Oven or Furnace that's requisite for that Purpose.

THE Furnace must be but small and round, about a Foot high, and as wide; cover the same with a round Blade, in which must be a round Hole; about four Inches wide; upon this Furnace put another without a Bottom, of the same Dimension as the former, and let the Crevices of the Sides round about be well closed and luted: This Furnace must also have a Hole at Top. The lower Furnace must have a little Door at Bottom, about five Inches big. Before this fix a Sort of a Funnel, like a Smoak-Funnel to an Oven, and lute it close to the Furnace; then light some Charcoal on your Hearth, and when they burn clear, and are free from Smoak, convey them through the Funnel into the Furnace, till they come up so high as to fill half the Funnel. When every Thing is ready, and you have a clear Fire, then begin to colour your Foyles in the following Manner.

LAY the Foyles upon a Pair of Iron Tongs, hold them over the Hole that is a-Top the Furnace, so that the Fumes of the Coals may reverberate over'em, and move them so long about, till they are of a brownish Violet Colour; and this is done without any other Vapour or Smoak. When you have done with this Colour, put it by; and if you will colour others,

of



P. 60

Haleth

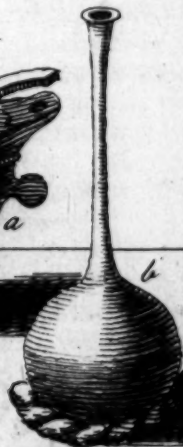


P. 60.

a. A small Furnace, with a Pan with Sand & another Utenfil with Liquid to evaporate.

b. A Matrafs.

c. A Furnace for colouring of Foyles.



d. A Balneum Mariae, with one Alembick.

e. An Iron Furnace.

f. The Cucurbit.

a. A Matrafs with its Head.



Huetts Sculp





of a Saphir or Sky Blew, then put the Foyles upon the Tongs as before; and whilst you with one Hand are holding the Foyles over the Holes, fling with the other some Down Feathers of a Goose, upon the live Coals in the Funnel, and with a red hod Poker press them down, to drive the Smoak of the Feathers up through the Holes of the Oven, which by settling upon the Foyles, gives 'em a fine Sky Colour: But you must have your Eyes very quick upon them, and as soon you see that they have attracted the Colour you design, take them away from the Oven, to prevent their changing into some other Colour: But if you will have your Foyles of a Saphir Blew, then first silver them over, which is done in this Manner.

TAKE a little Silver, and dissolve it in *Aqua Fortis*; when dissolv'd, put Spring-Water to it, fling thin Bits of Copper into it, and the Water will look troubled, and the Silver precipitate and hang to the Copper; pour off that, sweeten the Silver with fair Water, and let it dry in the Sun; when dry, grind it on a Porphyr-Stone: Then take one ounce of Tartar, and as much of common Salt, mix and grind 'em all together, till they are well mixed: This Powder fling upon the thin Foyles, and rub them with your Finger backwards and forwards, and it will silver 'em; then lay them upon the Polisher, pour Water over them, and some of the Powder, rub with your Thumb, till they are as white as you would have 'em: Polish them with the Polisher of Blood-Stone, and holding them over the Goose Feather Smoak, they will take a fine dark Blue.

*To colour Foyles of a green Colour for an EMERALD.*

YOU must first colour your Foyles of a Sky Blew, as directed before; then hold them over the Smoak-Hole, and below in the Funnel lay upon a red hot Iron Plate, Leaves of Box, from which ascends a Smoak that gives the Foyles a green Colour; but before they attract that Colour, they undergo several Changes, as blew, then red, and again yellow, wherefore you must hold them so long, till you have the green Colour to your Mind.

*To colour the Foyles of a RUBY Colour.*

PUT the Shearings of Scarlet Cloath upon the Coals, and holding the Foyles over the Smoak-Hole, they will attract a fine red Colour.

*The*

*The Colour of an Amethist*

**M**A Y be had in proceeding with your Foyles, as for the blew or Saphir Colour; for before that blew Colour comes, it first changes to an Amethist; as soon as you perceive this, take them off, and polish them.

*How the Foyles are mix'd with Copper, and other Metals.*

**T**H E S E are more difficult to make, but more lasting in their Colour. Take one pound and a half of Copper, and melt it in a Crucible; fling into this two ounces and 11 Penny-Weight of Gold; when in Fusion, pour it out into a flat Ingot, and let it cool: This beat and work, as has been taught, into thin Foyles; then boil them in Tartar and Salt. These Sorts of Foyles will take a fine Ruby Colour; nor can that Colour be well done without this Mixture.

*Another Way to make the Foyles.*

**T**A K E Small-Coal Dust, put it in a little Iron Oven, and in the midst thereof a live Charcoal; blow it till all the small-Coal Dust is lighted, and let this glow for two Hours: When it is most all glow'd out, add such another Quantity to it, and let it glow for an Hour. At the Top of your Oven must be a round or square Hole, with a close Cover to it, in which hang the Foyles to some Copper or Iron Wire: When your Small-Coal has glow'd for about an Hour, take a little Iron Bowl, and warm it well; put in it a little Quantity of Fox Hair, and then set it upon the Small-Coal Dust; shut the Oven Door, and open the Top: This will draw the Smoke through, and give the Foyles first the Colour of a Ruby, then of an Amethist, and at last of a Saphir. You may take out such Colours as will serve your Purpose; and if you want a Green, let those Foyles hang, and burn Sage Leaves, so long till the Foyles turn to a green Colour. Take care to put but a few Sage Leaves in at a Time.

To the Ruby and Hiacyinth Colour you use pure Copper, but to an Emerald and Saphir you must take one part of Gold and two parts of Silver, and eight Parts of Copper; melted and work'd together.

Choice

Choice Secrets to imitate PRECIOUS STONES, or  
to make ARTIFICIAL GEMS.

**T**HIS curious Art is arrived to that Perfection that it is capable of imitating Precious Stones in their Lustre, Colour, and Beauty, and even to surpass the natural ones, except in Hardness, which to obtain, has been, and no doubt are still the Endeavours of several ingenious Men.

THE Art of making artificial Gems, consists chiefly in rightly imitating the Tinctures of those that are real: These must be extracted from such Things as resist the Fire, and don't change their Colour, though of a Volatile Nature: Thus Verdegrease being put into the Fire, changes to another Colour, but when put in Fusion with Crystal, it retains its natural Colour.

You must therefore take such Colours as change not, when you have occasion to mix them together: As Blew and Yellow makes a Green, you must take such Blew that may not hurt the Yellow you mix with; and such a Yellow, that cannot be detrimental to the Blew, and so for the rest of the Colours. We shall give most plain and certain Instructions, to carry the ingenious Artist with Ease and Pleasure through this Labour, and first shew him,

*The Way of preparing Natural Crystal.*

**T**AKE natural Crystal, the clearest you can get, let the Pieces be bigger or less, it is no Matter; fill a large Crucible with them, and cover it with a Cover broader than the Mouth of the Crucible, to prevent the Ashes or Coals falling into it: Then put it into a small Furnace, on burning Coals; and when the Crystal is thorough hot, cast it into a pretty large Vessel of cold Water. Then take it out of the Water, dry it on an Earthen Plate, and put it into the same Crucible again: Cover it, and proceed as before, repeating it 12 times running, and changing each time the Water: When the Crystal easily breaks and crumbles, and is thorough white, it is a Sign that it is calcin'd enough: If there appears any black in the Veins, break off the white, and put the black again into the Furnace,

and



and proceed therewith as before, till only the white remains behind.

AFTER you have dried this Calcination thoroughly, grind it to an impalpable Powder, on a Marble or Porphir Stone, after you have searced it through a silken Sieve. Of this Powder of Crystal, as it is used for all artificial Gems, of which we shall treat, it will be best to have a sufficient Quantity by you, to have recourse to, when at Work; and if you will succeed in this Art, you must not use ordinary Frit of Crystal, let it be ever so good; for that will not answer or come up to the Resplendency or Fairness of natural Crystal.

*To make a fair Emerald.*

TAKE of natural Crystal four ounces, of Red Lead four ounces, Verdegrease 48 Grains, *Crocus Martis* prepared with Vinegar eight Grains; the whole finely pulverized and sifted. This put together in a Crucible, leaving one Inch empty; lute it well, and put it in a Potter's Furnace, where they make their Earthen Ware, and let it there stand as long as they do their Pots. When cold, break the Crucible, and you will find a Matter of a fine Emerald Colour, which, after it is cut and set in Gold, will surpass in Beauty the Oriental Emerald. If you find that your Matter is not refined or purified enough, put it again the second time in the same Furnace, and in lifting off the Cover you will see the Matter shining; you may then break the Crucible, but not before; for if you should put the Matter into another Crucible, the Paste would be cloudy, and full of Blisters. If you cannot come to a Potter's Furnace, you may build one yourself with a small Expence, in which you may put 20 Crucibles at once, each with a different Colour, and one baking will produce a great Variety of artificial Gems. Heat your Furnace with hard and dry Wood, and keep your Matter in fusion 24 Hours, which Time it will require to be thoroughly purified; and if you let it stand four or six Hours longer, it will not be the worse for it.

*A Deeper Emerald.*

TAKE one ounce of natural Crystal, six ounces and a half of Red Lead, 75 Grains of Verdegrease, 10 Grains of *Crocus Martis*, made with Vinegar; proceed as directed before.

*Another*

*Another Emerald Colour.*

**T**AKE prepar'd Cryſtal two ounces, Red Lead ſeven ounces, Verdegreaſe 18 Grains, *Crocus Martis* 10 Grains, and proceed as before directed.

*To make a Paſte for imitating an Oriental Topaze.*

**T**HE Colour of this Stone is like Water tinged with Saffron or Rhubarb: To imitate it, Take of prepar'd natural Cryſtal one ounce, of Red Lead ſeven ounces, finely pounded and ſearched; mix the whole well together, and put it into a Crucible, not quite full by an Inch, leaſt the Matter ſhould run over, or ſtick to the Cover of the Crucible in riſing; then proceed as directed above.

*Another.*

**T**AKE prepar'd Cryſtal two ounces, native Cinnaber two ounces, *Æs uſtum* two ounces, all fine pulveriz'd and ſearched; four times as much calcined Tin; put it all together into a Crucible well covered and proceed as before.

*To make an Artificial Chryſolite.*

**T**HIS Stone is of a green Colour, and ſome have the Caſt of Gold; To imitate it, take natural Cryſtal prepar'd, two ounces; Red Lead eight ounces, *Crocus Martis* 12 Grains; mix the whole finely together, and proceed as above, only leaving it a little longer than ordinary in the Furnace.

*To Counterfeit a Beryl.*

**T**HIS Stone is of a Blueiſh Sea-Green: To imitate it, take two ounces of natural Cryſtal prepared, five ounces Red Lead, 21 Grains of \*Zaffer prepared, the whole finely pulverized; put it in a Crucible, and cover and lute it; then proceed as directed above, and you will have a beautiful Colour.

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\* Preparing of Zaffer may be done, by putting ſome Pieces into an Iron Ladle, heating it red hot, and then ſprinkling it with ſtrong Vinegar, when cold grind it on a Stone; then waſh it in clean Water.

*A Sapphire Colour.*

**A** Saphir is generally of a very clear Sky Colour, and is highly esteemed for its Beauty. There are some of a Whitish Colour, like Diamonds, others a full Blue, and some are of a Violet.

To make this Paste, take of prepar'd Rock Crystal two ounces, Red Lead four ounces and a half, Smalt 26 grains; pulverize and proceed as directed. This Colour will come near to a Violet.

*Another more beautiful, and nearer the Oriental.*

**T**AKE two ounces of Natural Crystal prepared, six ounces of Red Lead, two Scruples of prepared Zaffer, and six Grains of prepared Manganese; all reduced to a fine Powder, mix and proceed as before.

*Another deeper colour'd Sapphire.*

**O**F prepared Natural Crystal take two Ounces, Red Lead five Ounces, prepar'd Zaffer 42 grains, prepar'd Manganese eight Grains; the whole reduc'd to an impalpable Powder, and mixed together; proceed as you have been directed, and you will have a Colour deeper than the former, tending to a Violet.

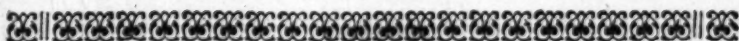
*To make a Paste for an Oriental Granat.*

**A** Granat is much like the Carbuncle; both, if exposed to the Sun, exhibit a Colour like burning Coals, between red and yellow; and this is the true Colour of Fire. To imitate this Stone, take two Ounces of Natural Crystal prepared, and six Ounces of Red Lead, also 16 Grains of prepared Manganese, and two Grains of prepar'd Zaffer; pulverize and mix the whole; put it together into a Crucible, and proceed as directed.

*Another deeper Granat.*

**O**F Natural Crystal prepared two ounces, Red Lead five ounces and a half, prepared Manganese 15 grains; pulverize all, and proceed as before directed.

*Another*



*Another Process for counterfeiting of PRECIOUS STONES.*

**T**AKE of black Flint-Stones what Quantity you please, and put them into a Pail of hot Water; and being wet, put them into a hot Furnace, this will prevent their flying into small Pieces; or else warm them thoroughly by degrees, before you put them into the Furnace. When you see that they are thorough red hot, then quench them in fair Water, and they will look of a fine White Colour; dry and pulverize them very fine: This you may do in an Iron Mortar; but as it may contract some of the Iron, it will be proper after you have taken it out, to pour on it some *Aqua-Fortis*, which will clear it of the Iron; and to disengage it from all the Filth and Impurities, wash it in several clean hot Waters.

THIS Powder thus prepared is fit to be used for making the finest Glass, and for imitating the most clearest and transparent Gems, especially those as require the Lustre of a Diamond or Ruby; as for a Saphir, Emerald, Topaze, Chrysolite, Spirel, Amethyst, &c. your Labour with *Aqua-Fortis* may be saved, if your Mortar is bright and free from Rust. Such as have a Mortar of *Porphire*, or such like Stone, have no occasion to use an Iron one, but will save themselves a good deal of Trouble.

IN case you cannot have black Flint Stones, you may content your self with Pebble; but Flint is far preferable, and makes the Glass of a harder Substance than that made of Pebble.

*An Approved Composition.*

**O**F the above Powder three parts, Fine refined Salt-petre two, Borax and Arsenick one part.

*Another.*

**O**F the Flint Powder three parts, Salt-petre two, and Borax four parts.



*Another.*

**O**F the foresaid Powder two parts, of refined Crystalline Pot-Ashes, or Salt of Tartar and Borax, of each one Part.

*Another.*

**T**AKE of the above Powder seven Parts and a half; purified Pot-Ashes five Parts: Or, Powder, six Parts and a half; Salt-petre two and a half; Borax one half; Arsenic one half; and Tartar one Part.

*How to melt these Compositions, and how to tinge and finish your Work.*

**T**AKE any one of the above specified Compositions, and weigh what quantity you please, one or two ounces, then mix it with such a Colour as you design to have it of, as for Instance.

*To make a Saphir.*

**T**AKE to one Ounce of the Composition four grains of Zaffer, mix it well together, and melt it in a Crucible; if you see the Colour to your liking, you proceed to finish it: you may make a Saphir either deeper or paler, according to what Quantity you take of each Ingredient; and 'tis the same with respect to other Colours. A new Practitioner in this Art may make Experiments in small Crucibles, in order to acquaint himself with the Nature thereof.

I have already given Receipts of most Colours for imitating of Precious Stones, but nevertheless I shall here lay down some experimental Rules, necessary to be observ'd.

You must know, that the *Crocus Martis* may be prepared different Ways, and each will have a particular Effect in Colouring of Crystals; the one is prepared with Vinegar, another with Sulphur, a third with Aqua-Fortis, and a fourth by only a reverberatory Fire.

*To prepare Crocus Martis with Vinegar.*

**T**AKE Iron; or, which is better, Steel-filings, moisten and mix them up with good Strong Vinegar in an Earthen

Earthen Dish or Pan; after which spread them and let them dry in the Sun; when dry, beat them fine in a Mortar: This Powder you moisten again with fresh Vinegar, and dry and beat it again as before; this you repeat eight times running, afterwards you dry and sift it through a fine Hair Sieve, and it will be the Colour of Brick dust: but when mixt with Glass, of a fine Crimson Colour. Put this Powder up carefully to preserve it from Dust.

*To prepare Crocus Martis with Sulphur, or Brimstone.*

**T**AKE Iron or Steel Filings, one Part; Sulphur three parts; mix it together and put it into a Crucible; cover and lute it well; then set it into a Wind Furnace, and give it a strong Fire with Charcoal, for four Hours together, then shake it out; and when cold, pulverise and sift it through a fine Sieve. This Powder you put into a Crucible, lute it, and place the same in the Eye or Hole of the Glass Furnace; let it stand there for 14 Days or more, and it will turn to a red Powder inclining to Purple; this is a very useful Ingredient for Tinging of Glass.

*To prepare Crocus Martis with Aqua Fortis.*

**M**OISTEN some Iron or Steel Filings in a glaz'd earthen Plate or Dish with *Aqua Fortis*, set it to dry in the Sun or Air; when dry, ground it to a fine Powder: Moistened it again with fresh *Aqua Fortis*, dry it, and proceed as before, repeating it several Times, till you see it of a high red Colour; then grind and sift it through a fine Hair Sieve, and put it safe from Dust for Use.

*To prepare Crocus Martis by a reverberatory Fire.*

**T**AKE clean Iron or Steel File-dust, put thereof into a large Pot or Pan about the quantity of an Inch high, cover it well, and put it in a Reverberatory Furnace, or any other place where it may be surrounded with a strong Heat and Flame. The Iron will swell and rise in a fine red Powder, so as to fill the Pot, and will even force up to the Cover Lid; this Powder you take off, and you will find a good part of Iron cak'd together at the Bottom, which you put again in the Furnace, where it will swell, and raise in a Powder, as before; this continue so long till you have a suf-

ficient Quantity. This is the most valuable *Crocus*, and of great use in the Art of Colouring or Tinging of Glass for counterfeiting of precious Stones.

*To make a fine Hyacinth,*

**Y**OU take of *Crocus Martis*, or of that by Reverberation prepared Iron Powder, 8 or 10 Grains, to one Ounce of the Composition.

*The Opal*

**I**S made of Silver dissolved in *Aqua Fortis*, precipitated with Salt; add to it some Load-Stone, and mix it up with the above Composition, it gives divers Colours, so as to represent a natural Opal.

*A reddish Stone*

**M**AY be made of the Fragments or Wast of Calcedon, mix'd with Borax and melted; with which you may make as many Changes as you please.

Such as will save themselves the Trouble of preparing the Composition for counterfeiting precious Stones, may use fine Crystal or Venice Glass, beat in a clean Mortar to a fine Powder; of this take eight Ounces, Borax two Ounces, refin'd Salt-petre one Ounce. Out of this Mixture you may melt and colour all Manner of Stones, with little Trouble.

*Bartholomew Korndorffer's Secret, to make a Diamond out of natural Crystal.*

**T**AKE the best polish'd Crystal, no matter whether large or small, so it is but clear and transparent; put it in a Crucible, with three Times as much of my fix'd Sulphur of Gold, so that the Crystal may be cover'd all over with it. Then, after you have put a Lid over it and luted the Crucible well, let it for three Days and Nights neal in a strong Fire; then take it out and quench it in Spring-Water, in which a red hot Steel has been quenched 46 Times running, and you will have a Diamond which resembles a natural one in every Respect, and is right and good.

Thus

Thus far *Korndorffer*, but how to come at his Sulphur he has left us in the dark.

*How to make a Diamond out of a Saphir, according to Porta's Description:*

**W**E used to make it (the Diamond) the most surest Way in this Manner: We fill'd an Earthen Pipkin or Crucible, with Quick-Lime, and lay'd the Saphir in the midst thereof, covering it first with a Tile, and then with Coals, all over, blowing them gentle till we had a clear Fire; for if it is blown too much, it may occasion the breaking of the Stone.

When we thought that the Saphir had chang'd its Colour, we let the Fire go out of it self; and took it out to see whether it was turned white; if so, then we laid it again in the Crucible, in order to let it cool with the Fire; but if it had not the right Colour, then we augmented the Heat again as before, and looked often to see, whether the force of Fire had taken away all the Colour, which was done in about five or six Hours; if then the blue Colour was not quite gone, we began our Operation from the first over again, till it was white and clear. It is to be observ'd, that the Heat of the Fire in the beginning of your Operation, must increase by slow Degrees, and also when done, it must in the same manner decrease; for if the Stone, comes either too quick in the Heat, or from the Heat in the Cold, he is apt to turn dark, or fly to Pieces.

In like Manner all other Precious Stones loose their Colour, the one sooner than the other, according as they are either harder or softer. The Amethyst is very light, and requires but a slow Fire; for if he has too much Heat, he becomes dark, or turns into Chalk.

This is the Art whereby inferior Precious Stones are changed into Diamonds; they are afterwards cut in the middle, and a colour given them; and from hence comes the second Sort of false Diamonds, or Doublets.

*To make a fine Amethyst.*

**T**AKE calcin'd Flint-Stone, and sift it thro' a Cambrick, whereof take one ounce and a half; of fix'd Salt-petre half an ounce; of Borax one ounce and a half; of *Tinct. Ven.* and *Mart.* 108 grains; Manganese, 100 grains; put both



both these Tinctures together, and then mix them with the Ingredients. Then add fix'd *Nitre* \* and *Borax* well mixt to it; put it into a Crucible in a Wind Furnace; give it at first a gentle Heat, till it is red hot, and thus keep it for a quarter of an Hour; then give it for two or three Hours a strong Fire, at last you pour it into a Mould, and let it cool by Degrees, to prevent its flying asunder.

*To make a Ruby, or a fine Hyacinth.*

**T**AKE Vitriol one Ounce, and the same Weight of Water, mix it well together; in this dissolve Filings or very thin beaten Steel; set the Glass on a warm Sand, filtrate the Solution before it is cold; then set it into a Cellar, and it will shoot Crystals, which pulverise; put it under a Muffel, and stir it so long, till you see it of a crimson Colour: Then take it off the Fire, put it in a Vial, pour on it good still'd Vinegar, and after it has stood four Days in a gentle Warmth, pour off that Vinegar, pour fresh to it, and let it stand four Days more; this you repeat till the Vinegar is observ'd to make no Extraction; then pour off the Vinegar, and there will remain at the Bottom of your Vial a Crimson colour'd Powder; sweeten this well with warm Water. This is the Tincture for the *Ruby* or *Hyacinth*.

Then take black Flints, calcine them well, as has been already directed, in order to bring them to a good white Powder, and sift this thro' a Cambrick; take thereof, and of Venice Borax, of each one Ounce; of the foresaid Tincture Powder eight or nine Grains; mix it well together in a Crucible, and give it for half an Hour a gentle Fire; then augment it by degrees, till you see your mixture in the Crucible as clear as Crystal, and of a Crimson Colour; then pour it into a Mould of what Shape you would have it.

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\* The fix'd Nitre is thus made: Take a Piece of green Oak, about two Fingers thick, lay it upon an Iron Plate, into the middle of the top of the Wood put a little heap of Salt petre; light it; and repeat it so often till it burns through the Wood, and the Salt petre runs upon the Iron: It turns at first blue, but afterwards greenish; you must keep it warm and dry, to prevent it from melting. In this manner one may make as much as one pleases.

*To make a Ruby Palais.*

**T**AKE prepar'd powder'd Flint 3 Ounces, fix'd Salt-petre one quarter of an Ounce; Borax 3 Grains; some of the above mentioned Tincture Powder; of Copper and Iron 54 Grains; of prepar'd Manganese five Grains; mix it all together, and put it in a new Crucible; give it at first a gentle Fire till it begins to melt, then give it a strong Fire for two Hours and let it cool of it self.

*To harden Bohemian Diamonds.*

**T**AKE black Lead two Ounces, Gold Talk two Ounces, powder it fine, and mix it well together; then take of this Mixture, put it into a new Crucible, about half full, and place the said Diamonds upon that Powder; so as not to touch one another; then put of the Powder as much upon them as will fill the Crucible; cover and lute it, and set it in a Coppel with Ashes, so as to have the Ashes a hands breadth about the Crucible; then give it a slow Fire, and augment the Heat by degrees, in order to preserve the stones from breaking, till the Pan or Coppel, which holds your Crucible, begins to be red hot; continue it thus for 48 Hours, then let it cool, and take the Stones out of the Crucible, and you will find them look black; polish them with Ashes of Tin, they will not only have contracted a tolerable Hardness, but have also a finer Lustre, much resembling natural Oriental Diamonds.

*A plain Direction concerning the Polishing of these Counterfeits; and also of Natural Gems.*

**I**T is to be observ'd, that all Glasse or artificial Stones may be cut and polish'd after one Method, namely, by strowing fine powder'd Emery upon a Leaden Plate, with Water, and holding the Stone firm; grinding it in what Form or Shape one pleases.

If you sling grounded *Tripoli*, mix'd with Water, upon a Pewter-Plate, and add a little Copper Ashes among it, it will have the same Effect.

Pulverized Antimony strow'd upon a smooth Plate of Lead, with *Tripoli* and Vinegar, polishes not only *Glass*, *Crystal*, *Granats*, *Calcedons*, *Agates* and *Amethist*, but all other natural Stones, except the Diamond. The Diamond is only cut with the Diamond Powder itself. Any such Diamonds, which can be touched by Emery, Lead, Copper or other Metals, or be cut therewith, are false; and this is a good Trial to know a real Diamond.

All other Precious and hard Stones can be grounded or cut with Metal and Emery, but the polishing is different.

The *Saphir* is after the Diamond the hardest; it may be polish'd best with Antimony and Vinegar, on Lead, or with calcin'd Flint-Stone and Water, upon Copper.

The *Ruby* is polish'd like the Saphir.

The Emerald and Turquoise is polish'd with Potter's Clay and Water, on Pear-Tree Wood, or with *Tripoli* upon Wood, or with Emery upon Pewter.

The *Beryl* is polish'd with calcined Mother of Pearl or Muscles, upon a Board covered with white Leather.

A *Pallas* is polish'd with Antimony, upon Copper.

The *Cornelian*, *Onyx*, *Agate*, *Calcedon* and *Jaspis* upon Tin; with *Tripoli* or calcin'd Flint upon Pear-Tree Wood; or with Antimony upon Lead.

The *Amethist*, *Topaz*, *Turquoise* and other soft Stones, are polish'd upon a Board of Lime-Tree Wood, upon a Plate of Tin, and upon a Board with Leather. First you polish it top and bottom, upon the Wood; the small Diamond Cuts are done upon the Plate of Tin, and receive the last polishing Stroke upon the Board that's cover'd with Leather, with the following Powder.

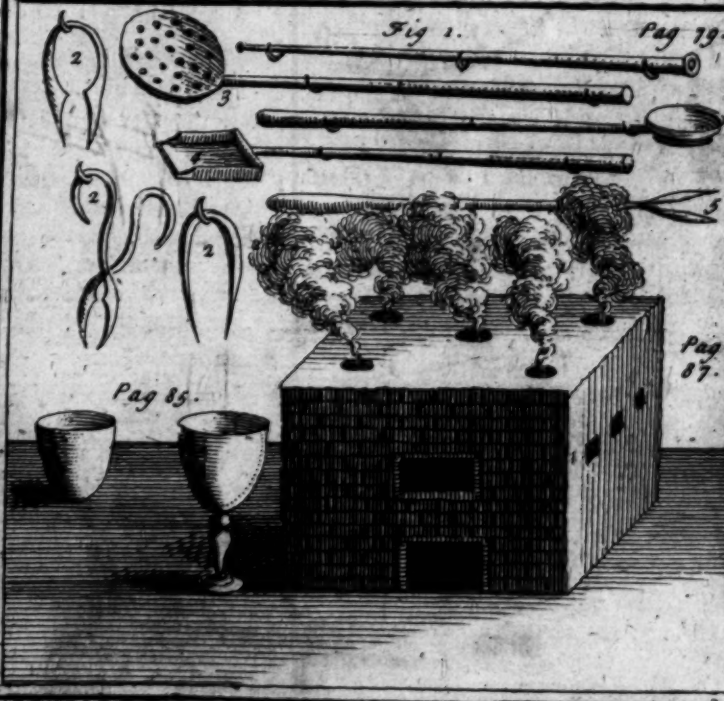
*A Powder for polishing soft Stones.*

**T**AKE Iron Scales, mix them with Vinegar and Salt, and let it stand thus infused for three or four Days, the longer the better; then grind it very fine, dry it, and put it in an Earthen Pot well luted; give it a good Fire, and it will be fit for Use.









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## P A R T. III.

**The Art of making GLASS: Exhibiting withal  
 the Art of Painting, and making Impressions upon  
 GLASS, and of Laying thereon Gold or Silver; to-  
 gether with the Method of Preparing the Colours  
 for POTTERS-WORK OF DELFT WARE.**

*To prepare Ashes for making of GLASS.*



**T**AKE what Quantity, and what Sort of  
 Wood-Ashes you will; except those of Oak,  
 have a Tub ready, with a Spiggot and  
 Foffet towards the Bottom, and in this Tub  
 put a lay of Straw, on which fling your  
 Ashes: Then pour Water upon them, and  
 let the Ashes soak thoroughly, till the Water stands above  
 them. Let it thus continue over Night; then draw out  
 the Foffet, and receive the Lee in another Tub, put under  
 the First for this Purpose. If the Lee looks heavy and  
 troubled, pour it again on the Ashes, and let it settle, till it  
 runs clear, and is of an Amber Colour. This clarify'd Lee  
 put by, and pour fresh Water on the Ashes; let this also  
 stand over Night; then draw it off, and you will have a  
 weak Lee; which, instead of Water, pour upon fresh Ashes.  
 The remaining Ashes are of great Use in Manuring of  
 Land.

After you have made a sufficient Quantity of Lees, pour  
 them into an Iron Cauldron, brick'd up like a brewing or  
 washing Copper; but let it not be fill'd above three Parts  
 full. On the Top of the Brick-work put a little Barrel with  
 Lee; towards the Bottom of which bore a Hole, and put a  
 small Foffet in, to let the Lee run gently into the Kettle,

in

in a Stream about the Roundness of a Straw: But this you must manage according to the Quantity of the Lee; for you ought to mind how much the Lee in the Kettle evaporates, and make the Lee in the little Barrel run proportionable, to supply that Diminution. Care must also be taken that the Lee may not run over in the first boiling; but if you find it will not keep in the Kettle, then put some cold Lee to it, slacken the Fire, and let all the Lee boil gently to a dry Salt: When this Salt is cold, break it out of the Kettle, put it into the Calcar, and raise your Fire by Degrees, till the Salt is red hot, yet so as not to melt: When you think it calcar'd enough, take out a Piece, and let it cool; then break it in two, and if it is thorough white, it is done enough; but if there remains a blackness in the middle, it must be put in the Calcar again, till it comes out thoroughly white. If you will have it still finer, you must dissolve it again, filtrate it, boil it, calcine or calcar it as before: The oftner this is repeated, the more will the Salt be cleared from the earthy Particles, and may be made as clear as Crystal, and as white as Snow; out of which may be made the finest Glass you can wish or desire.

According to Mr. Merret's Account, the best Ashes here in England are burnt from Thistles and Hop-stalks, after the Hops are gather'd; and among Trees, the Mulberry is reckon'd to afford the best Salt.

The most thorny and prickly Plants are observ'd to yield better and more Salt than others; also all Herbs that are bitter, as Hops, Wormwood, &c. Tobacco-stalks, when burnt, produce likewise Plenty of Salt. Notwithstanding this, it is observed that Fern-Ashes yield more Salt than any other Ashes.

*Another Method to prepare Pott-Ashes for making of fine Crystal Glass.*

**T**AKE Pot-Ashes, dissolve them in a clean earthen Vessel, in River- or Rain-Water; let them stand over Night, and settle; The next Day pour off the clear Matter, and filter the Settling through a Piece of Blanket, in order to get a clear Lee: This boil in an Iron Kettle, till it becomes a hard Mass; then beat it in Pieces, and put it in a Calcar to calcine: Dissolve it again in clear Water, filtrate and boil it as before; and the oftner you repeat it, the clearer and

and finer will be your Glafs: But if it is for colour'd Glafs once or twice doing it, will be fufficient.

*To make the Glafs Frit.*

**T**AKE White-Silver Sand; wash it, and separate all the filthy Matter from it, and let it dry, or rather Calcar it. Of this take 60 pound, and of the prepar'd Ashes 30 pound; mix it well together: Then set it in the melting Furnace; the longer it is melting, the clearer will be the Glafs made thereof. If it stands from Saturday Evening till Tuesday Morning, it will be fit to work with, or to tinge it with what Colour you please. Before you work it, add 40 pound of Lead and half a pound of Manganefe to it.

*Another Compound for fine Crystal.*

**T**AKE Ashes, prepar'd as above, 60 pound; of prepar'd Silver Sand 160 pound, Crystalline Arsenick four pound, White Lead two pound, clear dry Saltpetre 10 pound, Borax two pound; mix all well together, and proceed as has been directed, and you will have a beautiful Crystal.

*Another.*

**T**AKE prepared Silver Sand 20 pound, clear and dry Saltpetre 30 pound, Borax six pound, Crystalline Arsenick eight pound; mix this well together, and put it in Fusion for four Days together; then add two pound of Manganefe, and four pound of Borax.

*Another.*

**T**AKE prepared Silver Sand 38 pound, prepared Ashes 25 pound, Arsenick one pound, Saltpetre two pound, of Antimony and Borax four pound.

*Another.*

**O**F prepared Sand, take 40 pound, Saltpetre 13 pound and a half, Tartar six pound, Arsenick and Borax about one pound and a half.

*Ano-*



*Another.*

**P**REPARED Silver Sand 10 pound, Ashes six pound, Tartar three pound, Saltpetre four pound, Lime six pound, Borax 12 ounces.

*How to build a small Furnace, useful for Experiments in making of Glass and to serve on several other Occasions.*

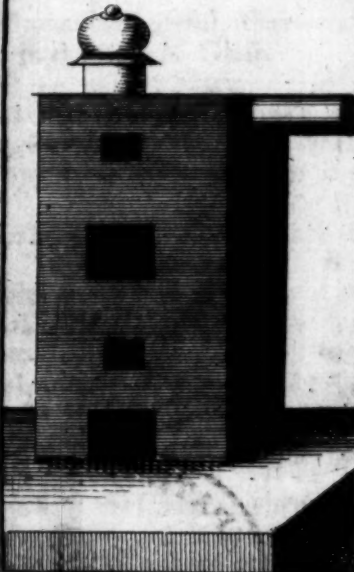
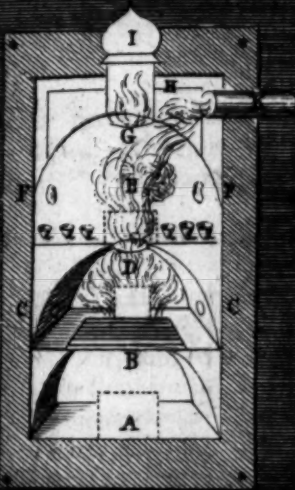
**Y**OUR Furnace, must be built according to the Situation, and Dimension of your Room, about a yard Square : At the Bottom you leave a hole, A, which is the Receiver of the Ashes, and also the drawer of the Wind to the Fire, which you may make as Fierce as you will, by exposing it either more or less to the open Air. B, is an Iron Grate, which is about a quarter and a half above the Hole A.

C, Are Holes over the Grate, wherein you put the Fewel; over the Grate is a brick'd Vault, wherein the Flames draw through the Hole D in the Upper Vault E.

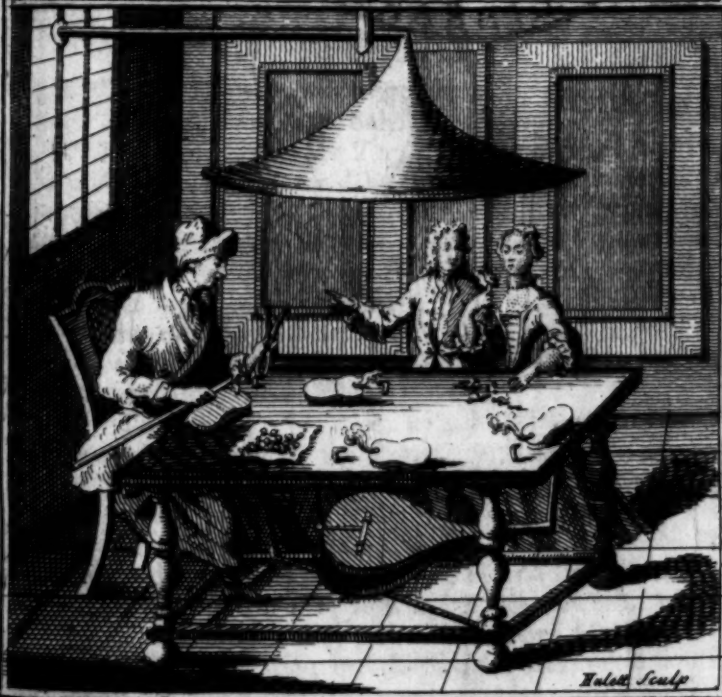
F, Are two or more Holes, through which you put the Crucibles in; you may make one on each Side, and make Cakes of such Clay as the Glass-makers use, to set them before the Holes, and by this means mitigate the Flames, which sometimes may strike too fierce upon the upper Vault, and give them a little vent.

G, Is a Hole in the Upper Vault, which may be cover'd and uncover'd as far as you will, and thro' which the Flame may either go straight through the Funnel H, which at the top is provided with a Cover I, and which on such Occasion must be taken off; or else in putting on the Cover I, you may convey a Reverberatory Fire through the Funnel K, into another little Reverberatory Furnace, which will be very useful for calcining and preparing several Matters, as may happen to be required.

The Inside of this Furnace must be lin'd smooth, with such Potters Clay as the Glass-Makers use, two or three Inches thick. And having finish'd it according to this Direction, you may place a good many Crucibles in at a Time, making the Holes through which you convey your larger Crucibles higher; so that the Rim of the Crucible may come even with the Bottom of the Hole, and you may easily convey a Ladle, Spattle, or any thing else through them. This Fur-



*A Small Furnace (P. 78.) for Experiments.*



*Hulton Sculp*

*The Art of Blowing Glass in Miniature. P. 83.*



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Furnace is the most compendious and useful, that can be contriv'd for a New Beginner in the Art of Glass.

The Principal Instruments that are used in making of Glass, are, 1. a hollow Pipe, for blowing the Glass, with a little Wooden Handle at Top, in order to manage it the better. Fig. 1.

2. The Scissars and Shears serve to cut and shape the Glass. Fig. 2.

3. Iron Ladles, whose Handles at the end are covered over with Wood; these serve to take the Metal out of the large Melting Pot, and to put it into the little ones for the Workmen; for Scumming the Metal; to take off the *Alkalick* Salt; which swims on the Top, and for several other Uses. Fig. 3.

4. Great and little Shovels or Peels, to take up Glass; to draw out the Ashes, &c. Fig. 4.

5. Several Sizes of Forks, to carry the Glasses, when made, into the upper Oven to cool; for stirring the Matter; for conveying the Melting-Pots in the Furnace from one Place to another, and for other Purposes. Fig. 5.

#### *General Observations on the Art of Glass.*

1. **T**HE Principal Ingredients for making of Glass, are Stone and Salt.

2. The Stone is either *Tarso*, a Sort of Marble brought from *Tuscany*, and reckon'd by several Artists to be the best for making of Crystal Glass; or Black Flint Stones, which in every Respect are as good. And where these are not to be had, clear Pebble or white Silver Sand, will, when rightly prepared, make also good Glass.

3. The next Ingredient is Salt, which, as has been said, is abstracted from Ashes, calcined and refined in the nicest and cleanest Manner possible.

4. *Pulverine* or *Rochetta*, are Ashes made of certain Herbs, which grow in the *Levant*, and are amongst Artists allow'd to be the fittest to abstract the Salt for making of Glass; of the same kind is *Soda*, which comes from *Egypt* and *Spain*. They prepare those Ashes thus: After the Herb has been dry'd in the Sun, it is burn'd on Iron Grates, the Ashes falling through it into a Pit underneath, made for that Purpose, where they grow into a hard Mass or Stone, and are laid up for use; but there is no occasion to fetch the  
Ashes



Ashes so far, when every Country produces sufficient of its own Growth; Herbs, as well as Trees and Plants answer in every Respect the same purpose.

Pot-Ashes and calcin'd Flint, Pebble, or Sand, will make good Glass Frit, after you have refin'd the Ashes, by first dissolving them in fair Water, and after they are settled, by boiling the clear Lees to a Salt, then nealing the Salt in a Furnace; dissolving it again, and proceeding as at first, repeating it several Times, till it produces a Salt as white as Snow. Of this you may mix three parts to four of calcin'd Flint, or as you find it requisite; in all which you will become more perfect by Practice than by Teaching.

5. Glass is also made of Lead, which first must be calcined; in doing this, you must observe that your Kiln be not too hot, but only so as to keep the Lead in Fusion, or else it will not Calcine. When the Lead is melted, it yields at the Top a yellowish Matter, which take off with an Iron Ladle for that purpose: After the first Calcination you repeat it again, and give it a Reverberatory Fire, till it comes to a good yellow Powder, and is well calcined. Of the calcined Lead you take seven Pound, and of the prepared Ashes six Pound. Care must be taken that no Settlement of Lead goes into the Crucible, but what is reduced to ashes, else it will make its Way through it, bore or rent the Bottom thereof, and carry all the Metal along with it.

6. *Manganese*, when prepared as directed, is of great use to whiten your Glass; for without it, it will have a green Hue; but by mixing Manganese with the Frit, when melted, by little and little, and then quenching the Glass in a Pail of Cold Water, repeating this several Times, it will make it of a white and clear Colour.

*To make Glass melt easy.*

**P**UT into the melting Pot a little of Arsenick that has been fix'd with Nitre, this will make the Glass mellow, and easy to fluviat.

*To calcine Brass, which in Glass makes a Sky or a Sea-green.*

**B**RASS, is Copper melted and mix'd with *Lapis Calaminaris*, which not only changes it into a Gold Colour, but increases it in Weight; which Augmentation gives a Sea-Green

Green or Sky Colour to Glafs, when it is well calcined; to do this, obſerve the following Rules.

Take Braſs Plate, cut in ſmall Slips, and put it into a Crucible, cover and lute it well, and give it a Reverberatory Fire in a Furnace, yet not a melting one; for if it melts, all your Labour will be loſt: let it ſtand in that Heat for four Days, by which Time it will be well calcin'd; then beat it to an impalpable Powder, and ſearce it; grind it fine on a Porphyre-Stone, and you will have a black Powder. which ſpread on Tiles, and keep it on Burning Coals, or the round Hole in a Furnace, for four Days; clear it of the Aſhes that have fell upon it, pulverize and ſearce it, and keep it for Uſe. To try whether it is calcined enough, ſling a little thereof into melted Glafs, which if it ſwells, the Calcination is enough, but if not, then it is either not calcin'd enough, or elſe it is burn'd, and it will not colour the Glafs near ſo well than when the Calcination is done to Perfection.

*To calcine Braſs after another Manner, for a transparent Red Colour, or Yellow.*

**C**UT your Braſs in ſmall Shreds, and lay it *ſtratum ſuper ſtratum* into a Crucible, with powdered Brimſtone; ſet it on a Charcoal Fire in a Furnace for 24 Hours, then powder and ſearce it: When this is done, put it covered into the Furnace Hole, for 10 Hours, to reverberate, and when cold, grind it again very fine, and keep it for Uſe.

*General Obſervations for all Colours.*

1. **A**LL the Melting Pots muſt be glaz'd with white Glafs the inſide, elſe a new Earthen Pot that is unglaz'd will cauſe the Colours to look bad and foul, but the ſecond time of uſing theſe Pots they loſe their Foulneſs.

2. Obſerve that theſe Pots ſerve for one Colour only, and may not be uſed for another; for every Colour muſt have its own Pot, except they correſpond together.

3. Let the Powders be well calcined, neither too much, nor too little.

4. Your Mixtures muſt be made in due Proportion, and the Furnace be heated with hard and dry Wood.

5. You muſt uſe your Colours divided; one part you muſt put in the Frit before it is melted, and the other after it is melted and become fine and clear.

*To make Glass of Lead, which is the fittest to be tinged with most Colours.*

**T**AKE of calcin'd Lead 15 Pound; of *Rochetta* or pulverized Crystal-Frit 12 Pound, mix it well and put it together into a melting Pot, then into a Furnace; and at the end of 10 Hours, cast it into Water; clear the melting Pot of the Lead that may remain, and return the Metal into it, which after 10 hours Heat will be fit to work withal.

*How to work the said Glass.*

**B**EFORE you take it upon the Iron, raise the Glass first in the Pot a little, then take it out to let it cool for a small space of Time, after which work it on a clean and smooth Iron Plate.

*Blue Glass.*

**T**AKE four ounces of calcined and pulverized Rock Crystal, two ounces of Saltpetre, one ounce of Borax, half a pound of Manganese, one pound of Indigo-Blue.

*A Chrysolite Glass.*

**T**O one pound of Frit, take pulverized Verdegreafe three ounces and a half, Red Lead one ounce.

*Saphir Green Glass.*

**T**O one pound of the above Composition or Crystal Frit take one ounce of good Zaffer, of curious fine Pin-Dust two pound.

*To make fine green Glass out of Tin.*

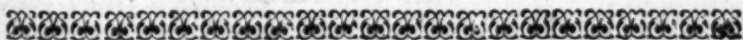
**T**AKE the Filings or Shavings of Tin, nine parts, dissolve it in Aqua Fortis, which is made of two parts of Vitriol, and three parts of Salt petre; sweeten the Calx with clean Spring Water; then take 18 parts of nine times or more calcined Antimony: its Calcination must be repeated 'till it has done evaporating. Both these Calx melted together, makes a fine Chrysolite or Emerald.

This

This Glass will melt upon Silver, like Enamel, and may be used on several Occasions, for Embellishing such Things, as are proper for Ornaments.

*To make a Ruby-Colour'd Glass.*

**T**AKE well settled Aqua Fortis, made with *Sal-Armoniac* into *Aqua Regis*, four Ounces; fling into it by little and little thin Bits or Filings of Tin, one Ounce, and let it dissolve: Then take the finest Gold, as much as you will, and dissolve it also in that *Aqua Regis*: Take a clean Glass with clear Spring Water, and pour off the Solution of the Gold as much as you please in it; the same quantity put also to it of the Solution of the Tin, and the Water will turn in a moment to a fine Rose Colour; with this Water moisten several Times your Glass Frit, and let it dry; then proceed as you do with other Glass in Fire; at first it will come out White, but turn to a fine Ruby.



The Art of Blowing GLASS in MINIATURE.

*This Art is perform'd by the Flame of the Lamp in the following Manner.*

**F**IRST, provide your self from the Glass Houses with several Pipes of Glass, that are hollow the inside, of several Colours, and different Sizes; then you must have a Table, as you see represented in the Plate annexed. A is the Lamp, which is furnish'd with Rape or other Oil, and a large Wick of twisted Cotton; below the Table is a Bellows, B. When the Artist treads the Treadle fasten'd to the Bellows, the Wind will be convey'd through the Pipes under the Table to the small pointed opening by C, directly against which is plac'd the lighted Wick of the Lamp, D. The Smoak which issues forth from the Lamp, is convey'd through a broad Funnel made of Tin or Wood. E.

The Wind which strikes in a sharp Point against the Flame, occasions such a violent Heat that it will dissolve the most stubborn Glass, and you may, after you have soften'd the End of your Pipe in the Flame, blow through the hollow thereof,



and form with small Pliers and other useful Tools whatever you please: small twisted Nooses of Wire are very convenient to hold your Work in, in order to shape and join different Colours to one Piece. The whole Art depends chiefly upon Practice.

The Usefulness of such a Table answers several other Purposes; as, for trying of Metal-Oar; in this Case put some of it on a hollow'd Charcoal, &c. and by directing the Wind through the Lamp upon the Oar, the Heat will melt it immediately, and shew what it contains. In Soldering it is also very convenient; not to mention the Conveniency which such a Table affords to Practitioners in Chymistry.

*How to lay Silver on Glass Utensils, as Plates, Dishes, Salts, Drinking Cups, &c.*

**T**AKE Silver, what Quantity you please, and beat it very thin, or corn it; then put it into a Matrafs, and pour twice the Weight thereof of Spirit of Nitre upon it, and you will presently perceive the Silver to dissolve: When you observe its ceasing to work, put your Matrafs on warm Sand or Ashes, and it will begin to work a-fresh; let it thus stand so long, till all your Silver is resolv'd. After this pour the Solution out of that Matrafs into another, that has a Head to it; with this draw off half the Spirit of Nitre from the Solution of Silver, and let the Matrafs remain on the Sand, till it is cool; then take it off, and let it stand still for four and twenty Hours, and the Silver will shoot into white Crystals; from these pour off the Solution which remains, and abstract from that again the half of the Spirit; then put it up as before, to crystallize, and this repeat, till near all the Silver is turn'd into Crystals; which take out of the Glass, lay it upon whited brown Paper to dry, and preserve it for Use. The rest of the Silver that should remain in the *Aqua-Fortis*, may be drawn out as has been directed before.

Of this Crystal take as much as you will; and put it into a Retort; pour upon it twice or three times as much in Weight of the strongest *Spiritus Salis Armoniaci*, lute it well, and put it in a gentle Warmth 8 or 14 Days to digest, and it will contract a blue Colour; pour it off, filter and abstract in *Balneum Mariæ* almost all the Spirits from it, and there remains a grass green Liquid; with this, draw over your Glass, and put it in a Glass Furnace, or in any gentle

gentle Heat; your Glass will look as though it were Silver Plate.

But in Case there should be an Oversight, and the Spirit of *Sal Armoniac* be too much drawn off, and the Silver turn'd to a green Salt, then pour as much of that Spirit upon the Silver again to bring it into a green Liquid.

*A Curious Drinking Glass.*

**T**AKE two smooth Drinking Glasses, fitted close into one another, so that the Brims of both may be even; then paint on the inside of the larger Glass, with Oil Colours, what you will, either in imitation of Mosaick, or any other Invention; and when dry, you may with the Point of a Needle open fine Veins or other Embellishments, &c. Then oil it all over with old Linseed Oil, and before it is quite dry, and clammy, lay Leaf Gold upon it, press it close down to the Glass with Cotton, and let it dry thoroughly. The mean while take the other lesser Glass, and lay a thin clear Varnish on the Outside thereof; and when most dry, lay on Leaf Gold, and the inside of the Glass will look all over gilded. When this is dry, put it into the larger Glass, and make a Paste of Chalk and Lack Varnish; with this lute the Rims of the two Glasses, so that it may not be perceived, but look as if it were made out of one piece; let it thoroughly dry, and give it another lay of Lack Varnish with a fine Pencil, and let it dry; then smooth it with Pumice Stone, and lay on a thin Varnish, and when that is most dry, gild it with Leaf Gold, and give it two or three Lays of Lake Varnish, and the Gold will remain secure.

When instead of Painting with Oil Colours you only anoint the inside of the Glass with old Linseed Oil, and then strew it over with *Spangles*, and put the inside-Glass gilded to join, it will have a singular Beauty. This Lesson will animate the Ingenious to try further Experiments of this amusing kind.

*How to Quicksilver the Inside of Glass Globes, so as to make them like Looking Glass.*

**T**AKE two Ounces of Quicksilver, one Ounce of Bismuth, of Lead and Tin half an Ounce of each.

First put the Lead and Tin in Fusion, then put in the Bismuth; and when you perceive that in Fusion too, then

let it stand till it is almost cold, and pour the Quick-silver into it.

After this, take the Glass Globe, which must be very clean, and the Inside free from Dust; make a Paper Funnel, which put in the Hole of the Globe, as near to the Glass as you can, so that the Amalgama, when you pour it in, may not splatter and cause the Glass to be full of Spots; but pour it in gently, and move it about, so that the Amalgama may touch every where. If you find the Amalgama begin to be curdly, and to be fix'd, then hold it over a gentle Heat, and it will flow easy again. And if you find the Amalgama too thin, add a little more Lead, Tin and Bismuth to it. The finer and clearer your Globe is, the better will be the Looking Glass.



### The Art of PAINTING upon GLASS.

**T**HIS noble Art being the Admiration of all who have any tolerable Taste of Designing or Painting, it will not be improper to give the ingenious Enquirer after this Mystery some few Lessons, in order, not only to satisfy his Curiosity with the Nature thereof, but also, if he is inclin'd, to lead him into the Practice thereof; which we shall do in the plainest and shortest manner possible.

First then, Chuse such Panes of Glass as are clear, even and smooth.

2. Strike one Side thereof, with a clean sponge or a soft hair Pencil, dipt in Gum-Water, all over.

3. When it is dry, lay the clean Side of the Glass on the Print or Design you intend to copy, and with a small-pointed Pencil (furnish'd with a black Colour, and prepar'd for that purpose, as shall be directed) delineate the Outlines or Capital Strokes, and where the Shades appear soft, work them by dotting and easy Strokes one into another.

4. After you have finish'd your Out-lines and Shades in the best Manner you are able, take a larger Pencil, and lay on your Colours in their respective Places; as a Carnation in the Face, Hands, &c. Green, Blue, Red, or any other Colour on the Drapery, and so forth.

5. When you have done this, heighten the Lights of your

your Work carefully with an unsplit stiff Pen, with which you take off the Colour by way of hatching; in such Places where the Light is to fall the strongest, and is also of particular Use to give the Beard or Hair a graceful turn.

6. You may lay all Sorts of Colours on the same Side of the Glass you draw your Design upon, except the yellow; which you lay on the other Side, in order to prevent its flowing and mixing with other Colours, and spoil your Work

*Necessary Observations in the Baking of Glass after it is Painted.*

**F**IRST, your Furnace for baking Painted Glass must be, and is commonly built four Square, with three Divisions, as you see in the Print annex'd. The lower Division A, is for receiving the Ashes, and for a Draught for the Fire.

2. The Middle Division is for the Fire, which has an Iron Grate below, and three Iron Bars cross the Top, to set the Earthen Pan upon, which contains the Painted Glass.

The Third Division has the afore-mentioned Bars at the Bottom, and a Lid at Top, in which are five Holes for the Exhalation of the Smoak and Flame.

3. The Earthen Pan is made of good Potters Clay, according to the Shape and Dimension of the Furnace, about 5 or 6 Inches high, with a flat Bottom. It must be Fire-proof, and not larger than to have at least Two Inches Space all round, free from the Sides of the Furnace.

The Figure here annex'd will better explain the Description.

4. When you are going to bake your Glass, take Quick-Lime, which before-hand has been well Neal'd or made red hot in a fierce Coal Fire: When cold, sift it through a small Sieve, as even as you can, all over the Bottom of the Pan, about half an Inch thick; then with a smooth Feather wipe it even and level; when this is done, lay as many of your painted Glasses as the Room will allow. This continue, till the Pan is full, sitting upon every Lay of Glass a Lay of the mix'd Powder, very even, about the thickness of a Crown Piece. Upon the uppermost Lay of the painted Glass, let the Lay of Powder be as thick as at the Bottom. The Pan thus fill'd to the Brim, put upon the Iron Bars in the middle of the Furnace, and cover the Furnace with a Cover made of Potters Earth, lute it very close all round, to prevent all Exhalation but what comes through the Holes



of the Cover-Lid. After you have order'd the Furnace in this Manner, and the Luting is dry, make a slow Charcoal or dry Wood Fire at the Entrance of the Furnace; increase it by Degrees, least by a too quick Fire the Glass should be subject to crack; continue thus to augment your Fuel, till the Furnace is full of Charcoal, and the Flame conveys itself through every Hole of the Cover: keep thus a very violent Fire for three or four Hours, and then you may draw out your Essays, which are Pieces of Glass on which you painted some yellow Colour, and place them against the Pan; and when you see the Glass bended, the Colour melted, and of a qualified yellow, you may conclude that your Work is near done; you may also perceive by the Increase of the Sparklings of the Iron Bars, or the light Streaks on the Pan, how your Work goes on. When you see your Colours almost done, improve the Fire with some dry Wood, and put it so that the Flame reverberates all round the Pan; then leave the Fire and let it go out, and the Work cool of itself. Take it out, and with a Brush clear your Glass from the Powder that may lay upon it, and your Work is done.

The Colours in use for Painting upon Glass, are next to be treated upon, and are as follow:

*For a Carnation Colour.*

**T**AKE Menning one Ounce, Red Enamel two Ounces; grind it fine and clean with good Brandy, upon a hard Stone: This, if you bake it sparingly, will produce a good Carnation.

*A Black Colour.*

**T**AKE Scales of Iron from the Anvil Block 14 Ounces and a half; mix with it two Ounces of White Glass, one Ounce of Antimony, Manganese half an Ounce, grind it with good Vinegar to an impalpable Powder.

2. Take Scales of Iron one Part, and *Rocaille* one Part, grind it together very fine upon an Iron Plate, for one or two Days; when it begins to be tough, and looks yellowish, and clogs to the Muller, it is a Sign that it is fine enough.

3. Take one Pound of Enamel, three quarters of a Pound of Copper Flakes, and two Ounces of Antimony, grind it as before directed; Or,

4. Take

4. Take Glafs of Lead three Parts, Copper Flakes two Parts, and one Part of Antimony, proceed therewith as before.

*A Brown Colour.*

**T**AKE one ounce of white Glafs or Enamel; half an ounce of good Manganese; grind it first with Vinegar very fine, and then with Brandy,

*A Red Colour.*

**O**NE ounce of red Chalk, ground and mix'd with two ounces of ground white Enamel and some Copper Flakes, will make a good Red; you may try with a little, whether it will stand the Fire, if not, add some more Copper Flakes to it.

*Another Red Colour.*

**T**AKE red Chalk, that is hard and unfit to write withal, one part; of white Enamel one part; and one fourth part of Orpiment; grind it well together with Vinegar, and when you use it, avoid the Smoak, which is poisonous.

*Another.*

**C**ROCUS Martis, or the Rust of Iron; Glafs of Antimony, and yellow Lead-Glafs, such as the Potters use, of each an equal Quantity; a small matter of Silver, calcined with Sulphur; grind it together very fine, and it will be fit to paint withal, and produce a good Red.

*Another.*

**T**AKE one half of Iron Flakes, one half of Copper Ashes, one half of Bismuth, a little Silver Filings, 3 or 4 Beads of Red Coral, 6 Parts of red Frit from a Glafs-Houle, one half of Litharge, one half of Gum, and 13 parts of red Chalk,

*A Blue Colour for Glafs Paint.*

**T**AKE Burgundy Blue or blue Verditer, and Lead-Glafs, an even Quantity, grind it with Water to a very fine Powder, and when you use it, lay the Flowers that are to be of a blue Colour, all over therewith; then raise the yellow  
Parts

Parts open with a Pen, and cover them with a yellow Glass-Colour; observe, that blue upon yellow, and yellow upon blue, always makes a Green.

*Another Blue Glass Colour.*

**B**LUE Verditer or Smalt, mix'd with Enamel, will make a good blue Paint.

*A Green Glass-Colour.*

**G**REEN Rocaille, or small Beads of the same Colour, two Parts, Brass File Dust, one Part; Menning two Parts, grind it together clear and fine, and you will have a good Green when it comes out of the Pan.

*Another Green.*

**Æ**S Ustum 2 ounces; Menning 2 ounces; fine white Sand 8 ounces: Grind it to a very fine Powder, and put it into a Crucible; then lute the Covering and give it for one Hour a good brisk Fire in a Wind-Furnace. After this, draw it off to cool; when cold, pound it in a Brass Mortar, adding the fourth Part in Weight to the Powder; grind and mix it well together, and put it in a Crucible; then cover and lute it well, and give it a good Heat for two Hours in a Furnace.

*A fine Glass for a Yellow Paint.*

**I**T has been found by Experience, that the best Yellow for Painting upon Glass is prepared out of Silver; wherefore if you will have a fine and good Yellow, take fine Silver, beat it into thin Plates, and dissolve and precipitate it in Aqua-fortis, as has been directed; when it has settled, pour off the Aqua-fortis, and grind the Silver with three times the Quantity of well burn'd Clay out of an Oven, very fine, and with a soft Hair Pencil lay it on the smooth Side of the Glass, and you will have a fine Yellow.

*Another.*

**M**ELT as much Silver as you please in a Crucible, and when in Fusion, sling by little and little so much Sulphur upon, till it is calcined; Then grind it very fine on a Stone

Stone; mix it with as much Antimony as the Weight in Silver; and when these are well ground together, then take yellow Oaker, Neal it well, and it will turn to a Brown-red, which quench in Urin, and take thereof double the quantity above specified; mix it all together, and after you have ground it very fine, lay it on the smooth Side of the Glass.

*Another Method.*

**N**EAL some thin Plates of Silver, then cut them into small Bits, put them with Sulphur and Antimony into a Crucible; when it is dissolv'd, pour it into clear Water, and thus mix't together, grind it very fine.

*A Pale Yellow.*

**S**TRATIFY thin Plates of Brass in an earthen Pipkin with powdered Sulphur and Antimony, and burn it so long till it yields no more Flame; then pour it red hot into cold Water; take it out and grind it fine. Of this Powder one part; of yellow Oaker, after it is Neal'd and quench'd in Vinegar, five or six parts; let it dry; then grind it on a Stone, and it will be fit for Use.

*How to deaden the Glass, and fit it for to paint upon.*

**T**AKE two parts of Iron Flakes; one part of Copper Flakes; three Parts of white Enamel; grind it all together with clear Water on a Marmor Stone, or upon a brass or Iron Plate for two or three Days, as fine as possible; with this rub your Glass well over, especially that Side you draw your Design upon, and you will finish your Work much neater.

*Some general Observations in the Management of Painting and Baking of Glass.*

**F**IRST when you lay your Glass into the Pan, let the painted Side be undermost upon the Lime, and the Yellow uppermost.

2. Dilute all your Colours with Gum-Water.
3. Grind the Black and Red upon a Copper Plate, other Colours you may grind on a Piece of Glass, or a Stone.
4. Glass-Colours ready prepared, are Glass Enamel, that's brought from Venice in Cakes, of most Sorts; also the small Glass Beads, that are brought over from Germany, especially



cially from *Franckfurt* on the *Main*. Old broken pieces of painted Glass are good for that purpose, so is the Green Glass of Potters, and the Glass Drops that run from the Ware in the Furnace.

5. The Colours which are used by Potters, for painting on earthen Ware, may also be used in painting upon Glass.

*A particular Way to paint upon a Drinking Glass.*

TAKE a small quantity of Linseed, bruise it and put it for four or five Days in a little Canvas Bag, in Rain-Water, and change the Water every Day; then press out the Moisture, and you will have a clammy Substance, like Glue; with this grind your Colours as usual, then paint or mark with a Pencil what you please upon the Glass, and give it by degrees a thorough Heat; with the same Glue you may also gild upon the Glass, before you put it to the Fire.

*A fine Gilding upon Glass.*

TAKE Gum-Armoniac, dissolve it over Night in good White-Wine Vinegar, and it will be as white as Flower; pour off the Vinegar into another Vessel, and grind the Gum-Armoniack and a little Gum-Arabick well together with clear Water; when they are well incorporated and fine, then write or draw upon your Glass what you please; and when almost dry, so that it is but a little clammy, then lay on your Gold, press it down with some Cotton, and let it stand over Night, rub the loose Gold afterwards with a little Cotton gently off the Glass, and you will see the Ornaments, Figures or Writing in that Perfection as you design'd them; then dry it slowly over a gentle Heat, increasing it by degrees so as to make it Red Hot; let it cool of itself, and the Gold will look fine, and stand either Wine or Water.

*To Write or Draw upon Glass.*

TAKE two parts of Lead, one part of Emery, and a little Quantity of white Lead, grind it very fine with clear Water, then temper it with Gum-Water, and with a soft Hair Pencil lay it all over the outside of your Glass, and when dry, you may with a Pendraw or write upon it what you please; then increase the Fire from a gentle warmth to make the Glass red hot; let it cool, and you will see your Drawing or Writing fair upon the Glass, which will not be defac'd either by cold or hot Water.

The



The Art of Glazing and Painting on fine Earthen,  
commonly call'd DELFT WARE.

**P**OTTERS who paint with Colours on Earthen Ware, may be rang'd in the same Class with Painters upon Glas, since they use almost the same Materials, and in many Respects, the same Method.

What has already been said under the foregoing Head, is sufficient, and may serve Practitioners in Designing and Painting as an Instruction to paint Flowers, Landships, Figures or whatever else, upon Earthen Ware. We shall however here set down some Receipts that chiefly relate to the Glazing of Earthen Ware, but First shew,

*How to prepare the Clay for fine Delft Ware.*

**T**AKE one part of Calcin'd Flint; one part of Chalk, and one part of Capital or the Cream of Clay, mix and Work it well to a proper Substance.

*To prepare a White Glazing.*

**T**AKE of Lead two pound; Tin one pound; calcine it to Ashes, as has been directed before. Of this take two parts; calcined Flint or Pebble, one part, Salt one part, mix it well together and melt it into a Cake.

*The Rotterdam fine shining White.*

**T**AKE of clean Tin Ashes two pound, Lead Ashes ten pound, fine Venice Glas two pound, Tartar half a pound, and melt it to a Cake.

*Or,*

**L**EAD Ashes eight pound, Tin Ashes three pound, fine clear calcined Flint or Pebble six pound, Salt four pound; melt it into a Cake.

*Another.*

*Another.*

**C**ALCINE eight pound of Lead and four pound of Tin into Ashes; of theſe take one Quart, Salt and Pebble of each one pound, and melt it into a Cake.

*Another fine White for Earthen Ware.*

**C**ALCINE ſix pound of Lead, and three pound of Tin to Ashes, whereof take two parts, Salt three parts, Pebble or Flint three parts, and melt it into a Cake.

*Another White.*

**T**AKE eight pound of Lead and four pound of Tin Ashes; among which mix ſix pound of Venice-Glaſs, and a handful of Rock-Salt; melt it into a Cake.

*Saltzburg White.*

**T**AKE three parts of Lead, ſix parts of Tin; or ſix parts Lead and three parts Tin, Salt three parts, Tartar one part, and Pebble five parts, &c.

*Or,*

**T**AKE five pound of Lead, one pound of Tin, three pound of Flint, three pound of Salt, &c.

*Another White.*

**T**AKE ſix pound of Lead, one pound of Tin, melt and burn it to Ashes; whereof take 12 Spoonfuls, 12 ſpoonfuls of Flint, and 12 of fine Wood Ashes.

*To lay a Ground upon Earthen Ware, on which the white Glaſs will better ſpread.*

**T**AKE calcin'd Tartar one pint, Flint and Salt of each one pint, mix it together, and uſe it for a Lay or Ground over your Earthen Ware, before you glaze it.

*The*

*The right Dutch Mastirat for White Porcelain.*

**T**AKE calcin'd Pebble, Flint or Sand, 100 pound, Soda 40 pound, Wood Ashes 30 pound. This Mixture is by the Dutch call'd *Mastirat*; of this take 100 pound, Tin and Lead Ashes together 80 pound, common Salt 10 pound, and melt it three Times into a Cake.

The Tin and Lead Ashes are made out of 100 pound of Lead and 33 pound of Tin.

*The Common Ware is thus Glazed.*

**T**AKE 40 pound of clear Sand, 75 pound of Litharge or Lead-Ashes, 25 pound of Pot-Ashes, and ten pound of Salt; melt it three Times into a Cake, quenching it each time in clear cold Water.

*Or,*

**T**AKE clean Sand 50 pound, Lead Ashes 70 pound, Wood-Ashes 30 pound, Salt 12 pound, melt it to a Cake.

With this Mixture they glaze fine and coarse Ware, and set it in an Earthen glazing Pan, which is round; the Ware is set in them upon three corner'd Bars, that go through the like holes in the Pan, and the Ware is kept asunder from touching one another.

The opening before, is only left in the Figure to see how the Ware stands, otherwise the Pan must be entirely clos'd up.



## Of Several Colours for POTTERS GLAZE WORK.

*A Fine Yellow.*

**T**AKE Red Lead three plnts, Antimony and Tin, of each two pound, melt it into a Cake, grind it fine, and melt it again. This repeat several Times, and you will have a good yellow.

*Another.*



*Another.*

TAKE 15 parts of Lead Oar, three parts of Litharge of Silver, and 15 parts of fine Sand.

*Another.*

TAKE eight parts Litharge, nine parts of calcin'd Flint, one part Antimony, and a little Iron Filings, calcine and melt it into a Cake.

*Fine Citron Yellow.*

TAKE six parts of Red Lead, seven parts of fine Red Brick-duft, two parts of Antimony, melt it into a Cake.

*A Green Colour.*

TAKE eight parts of Litharge, eight parts of Venice-Glass, four parts of Brass Dust, melt it for use.

*Another.*

TAKE 10 parts of Litharge, 12 parts of Flint or Pebble, one part of *Æs ustum* or Copper Ashes;

*Blue Colour.*

TAKE Lead Ashes one pound, clear Sand, or Pebble two pound, Salt two pound, white calcin'd Tartar, one pound, Venice or other Glass 16 pound, Zaffer half a pound, mix it well together and melt it; quench it in Water, and melt it again; this repeat several times: But if you will have it fine and good, it will be proper to put the mixture in a Glass Furnace for one or two Days.

*Another.*

TAKE Litharge four pound, clear Sand two pound, Zaffer one pound, calcin'd and melted together.

*Another.*

TAKE 12 pound of Lead, one pound of Tin, and one pound of Zaffer, five pound of Sand, and three pound of

of Salt, Tartar and Glafs one Pound, calcine and melt it in a Cake.

Or,

**T**AKE two pound of Litharge, a quarter of a pound of Sand, one pound of Zaffera, and one pound of Salt; melt this as directed.

Or,

**O**NE part of Tartar, one part of Lead Ashes, one part of Zaffera, one part of Sand, and two parts of Salt; melt it as before.

*A Brown Colour.*

**T**AKE of common Glafs, and Manganefe or Brown-Stone, of each one part, Lead Glafs 12 parts.

*A Flesh Colour.*

**T**AKE 12 parts of Lead-Ashes, and one of white Glafs.

*Purple Brown.*

**T**AKE Lead-Ashes, 15 parts, clear Sand 18 parts, Manganefe one Part, white Glafs 15 Measures, and one Measure of Zaffera.

*Iron Gray.*

**T**AKE 15 parts of Lead-Ashes, 14 parts of white Sand, five parts of Copper Ashes, one of Manganefe, one of Zaffera, and one of Iron Filings.

*A Black.*

**T**AKE Lead-Ashes 18 Measures, Iron Filings three, Copper Ashes three, Zaffera two Measures; this, when melted, will make a brown-black but; if you will have it blacker, put some more Zaffera to it.

*Brown on White.*

**M**ANGANESE two parts, Red Lead and white Glass one part; melt it well together.

*A fine Red.*

**T**AKE Antimony two pound, Litharge three pound, Rust of Iron calcined one pound, grind it to a fine Powder.

*To glaze with Venice Glass.*

**W**HEN your Ware is well dry'd, and ready to bake, strike it all over with White-Wine Lees; then lay on the Venice Glass (ground fine and mixt with *Sal Tartar* and Litharge) and bake it as directed.

*A Green.*

**T**AKE Copper Dust two parts; yellow Glass two parts; melt it twice.

*Or,*

**T**WO parts of Copper Filings, one of Lead-Ashes, and one of white Glass; melt it to a Cake.

*Yellow.*

**M**ENNING three parts, Brick-dust two parts, Lead-Ashes two parts, Antimony two parts, Sand one part, of the above white Glass one part, well calcin'd and melted.

*Or,*

**R**ED Lead four ounces, Antimony two ounces, melt it to a Cake.

*Gold Yellow.*

**T**AKE of Antimony, Red Lead and Sand, an equal Quantity, and melt it to a Cake.

*A fine*

*A fine Blue Glass to paint with.*

**T**AKE Lead-Ashes one pound, clear Sand two pound, Salt two pound, white calcin'd Tartar one pound, Flint Glass half a pound, Zaffer half a pound, melt it together and quench it in Water; then melt it again, and repeat this several times.

Zaffera finely ground by itself, makes good blue, to paint upon white-glaz'd Earthen Ware.

*A Brown.*

**O**NE part of Manganek, one of Lead, and one of white Glass.

*A Liver Colour.*

**T**AKE 12 parts of Litharge, eight of Salt, six of Pebble or Flint, and one of Manganek.

*A Sea-Green.*

**T**AKE five pound of Lead-Ashes, one pound of Tin-Ashes, three pound of Flint, three quarters of a pound of Salt, half a pound of Tartar, and half a pound of Copper dust.

*To lay Gold, Silver, or Copper on Earthen Ware, so as to resemble either of these Metals.*

**M**AKE an Utensil of fine Potters Earth, form and shape it thin, neat, and Silver Fashion; then bake it, and when bak'd, glaze it: but before you bake it again, if you will silver, gild or copper it, take a Regulus of Antimony, melt your Metal with it, and beat it to a Powder, grind it with Water very fine, and glaze it therewith. Then bake it, and when done, the whole Utensil will look like Silver; for when it comes in the Fire, the Antimony evaporates and leaves the Silver, &c. behind. But if you will silver or gild it only for Ornament sake, and keep it from any Wet coming to it, then you may lay on the Gold or Silver Leaves with Brandy, and afterwards polish and finish it in the best Manner, after the common Method.





## PART IV.

Several uncommon Experiments for *Casting* in SILVER, COPPER, BRASS, TIN, STEEL, and other Metals; likewise in WAX, PLAISTER of PARIS, WOOD, HORN, &c. With the Management of the respective Moulds.

*To prepare Clay in such a Manner as to be fit to make all manner of Moulds to cast Gold, Silver and other Metals in them.*



TAKE Clay, as much as you will, put it into an Earthen Pot that's glaz'd, and cover and lute it very close; then put it into a Potters Furnace, and let it stand as long as other Earthen Ware. After it is burn'd and cold, grind the Clay upon a Colour Stone very fine, sift it through a fine hair Sieve into clear Water, and after it is settled, pour off the Water, and grind the Clay once more upon the Stone, as fine as possible; then wash it again in fair Water as before, and set it in the Sun or in a warm Place to dry.

After this burn'd and wash'd Clay is thorough dry, take thereof three pound, *Sal-Armoniac* two pound, Tartar two pound, Vitriol one pound; mix this together, and put it in one or two Pots, pour upon it about seven quarts of clean Water, and boil this Composition for some time; then take this Water, whilst it is warm, and mix your burn'd Clay therewith to such a Substance that you may roll it into Balls; these lay in a warm Place to dry, and when dry, put them into an Earthen Pot as before, and give them another baking among the Earthen Ware, and when cold, grind them fine, and that Powder will be fit for Use.

The

The Clay being thus prepared, take *Sal-Armoniac*, put it into a Glais with Water that holds about two Quarts, put so much of the *Sal-Armoniac* to the Water as it will dissolve over a gentle Warmth, and let it stand one or two Hours closed up; then take your Powder of Clay, temper it with this Water to such a Substance as to roll it into Balls, and make what Moulds you please thereof. When you cast your Metal, you must make your Mould red hot; and be also very nimble in the pouring out your melted Metal.

*To make Moulds of Clay to cast Brass or other Metals therein.*

**T**AKE good clear Clay, such as the Pewterers use; take also Cloth Shavings or fine short-pluck'd Cotton, and fine clear Sand, and if the Sand is not fine enough, grind it on a Colour Stone; mix this with the Clay to such a Substance as is fit to make or form your Moulds thereof. Your Clay must not be made soft with Water, but with strong Beer, and when you cast, let your Mould be red hot. If you will have a fine and sharp Cast, sift over your Clay some fine wash'd Ashes, before you make the Impression.

*To prepare Moulds, which need not be heated for casting Metal in them.*

**T**AKE fine Sand, such as the Goldsmiths use, mix it with Lampblack as much as you think proper; then temper it with Rape or Linseed Oil, fit to make your Moulds thereof; whatever you cast in them, comes not only out neat and sharp, but you have no occasion to heat your Mould, as is required in others: This you must observe, that your Sand must be very dry before you temper it with the Oil.

*The Preparation of Mantua-Earth, for Moulds.*

**T**AKE Mantua-Earth one part, and one part of Charcoal Dust, burnt of Birch, and one part of Salt; then mix with it an equal Quantity of Tartar, boil it up together in a Copper Pan, and let it seeth or ebullate three times: with this Water, which keeps always good, moisten and temper your Earth, so as to form it into Balls between your Hands,

and when you will make your Mould, roll your Earth with a Roller, till it is smooth and pliable; then you may form it into what Fashion you please. In this Mould you may cast before it is dry; and when you have cast, take off the Earth which is dry'd through the Heat of the Metal, grind the same again, and temper it as you did at first to use it again.

*A Particular Sort of Mould, in which one may cast exceeding fine.*

**T**AKE Horse Mussels, or for want of them, Oyster-Shells, let them be calcin'd in a Potters Furnace, then pulverize and temper them with Urine; of this make your Moulds, and you will cast very fine and sharp.

*To Impress Bass Relievo or Medals, in Imitation of Ivory.*

**T**AKE of prepared Clay one pound, fine Plaster of Paris eight ounces, white Starch eight ounces; mix these together, and beat it up with the White of six or eight Eggs, put to it three ounces of clear Gum Arabick, stir it well together to a Paste, and put so much of the dry Mixture to it till you can knead it like Dough; then press it into a Mould with the Palm of your Hand, and let it dry in the Sun, observing thereby to lay the Paste side on a smooth Board, and it will be clear and hard, like Ivory. You may impress all manner of Medals and Curiosities, and make them of what Colour you please.

*To cast Vegetables in Moulds, peculiarly prepar'd for Silver.*

**T**AKE fine and clear Clay or Spalter, that's dry, and pound it fine in a Mortar; then take a Copper or Iron Pan, put in your Clay, and give it a brisk Fire, and after you have heated it thoroughly, take it off and let it cool; then take one part of this Clay, one part *Alumen Plumosum*, grind it together, and cast it in little Tents, which put into a Fire to Neal; beat it very fine; and when you will form your Plant, take one part of this Powder, and one part of *Alumen Plumosum*, grind it together, and add as much of the Clay Powder as the mix'd Matter doth contain, and mix and grind it all together. Then take some Potters Clay, to make a Coffin round your Plant; spread it in what manner you think proper, and after the Coffin is dry, anoint

the inside thereof, as also the Plant with good Brandy; dust the before prepared Clay and the Plant gently through a fine Cambrick, and when you have cover'd it all over as thick as it will bear, strike the rais'd Coffin a little with your Hand or Hammer, and the dust will settle closer to the Plant and make the Silver, cast in, come out the sharper.

After the Powder is well settled, and your Coffin closed, cover it first with dead Charcoal, and then lay some live ones over them; let the Fire gradually descend to the Coffin, and heat it by degrees to a strong Glue, then let it cool of itself with the Fire; take afterwards fine Clay, fine Sand and some Wool Shearings; mix this together, beat and knead it well in one another; then temper it with Glue, and fill your Coffin with it all over the Plant, leaving an opening at the Stalk for the Inlet; then put it again into the Fire and make it red hot, and with a pair of Bellows, first closed, draw out the Ashes from the Inlet, and it will be ready for Casting.

Then take Oil of Tartar, which is made of pounded Salt of Tartar, and scrape a little *Sal Armoniac* into it, to give it the Substance of a thin Paste, which is a good Flux for Silver; fling some of this upon your Silver when in Fusion, and it will cast fine and sharp.

After it is cast, anoint the Silver Plant with Oil of Tartar, lay it on live Coals, Neal it, and then boil it in Tartar, to which you add a little Salt, and this will give it a fine bright Pearl Colour.

*A curious Method to cast all sorts of Things in Gold, Silver, or other Metals.*

**F**IRST pound Plaister of Paris, or Alabaster, to a fine Powder, sift it through a Cambrick, or very fine Hair Sieve, and put it into an Iron Pan, over a clear Coal Fire; stir it about till it begins to boil, and bubbles up like Water; keep it stirring; recruit your Fire, and continue this so long till you find it so thick as not to be able to draw it along with your Stick; then pour it into a Bowl and let it cool.

Take also Brick-dust finely powder'd and sifted.

The Miners find sometimes a Matter in the Iron Mines, which they call Liver Oar; take this and wash it from the coarser Sand, and when dry, put it in an earthen Pot, cover it, set it to Neal thoroughly, and when cold, pound and sift it. When it is right burnt, it will be of a Copper Colour; put all



these different Powders in several Boxes, and preserve them from Dust and Soil, for proper use.

*To cast Vegetables and Insects.*

**F**OUR parts of the above Plaister of Paris, two parts Brick-Dust, and two parts Liver Oar; mix this well together, and sift it through a fine Hair Sieve, and when you are ready to form your Mould, pour clean Water to it, stir it well together to the Thickness of a thin Paste; but you must be pretty nimble with this Work, else it will harden under your Hands, and be of no Use.

*The Mould you prepare thus :*

**T**AKE the Plant you design to cast, and spread the Leaves and Stalks not to touch one another; then make a Coffin either of Lead or Clay, put your Plant in it, so as not to touch the Coffin; at the bottom you may lay a Piece of Paper, to keep the Stuff from sticking to the Board, but let your Stuff be neither too thick nor too thin, for if it is of a right Substance it will force itself close to the Plants, and come out sharp; let the Stalks be carefully kept up for the Inlet; and when you pour this Stuff upon your Plants, do it gently, and part those Leaves which might close to one another, with a Needle, pouring all the while, to make the Mould the stronger. After it is harden'd, put it in a dry Place, and keep it till you have some more ready to cast, but you must secure it from Frost.

If you will cast Insects, or any small Animal or Reptile, put them in what Position you will upon a little Board, brown Paper, or Paste-Board, which first must be anointed with Oil, in order to make the Plaister Stuff come off the easier; about your Insect make a little Coffin, and if you can rise the Insect so as to be free from the Board or Paper, it will be the better, which you may do by tying it with two or three hairs, fastening them at the Top of the Coffin, and by this means will hang in the middle thereof; when this is ready, pour, as before directed, your Plaister gently upon it, and after the Mould is a little dry, put it also by for use.

If you lay your Insect or other Creature on the Paper, and you must make a Wall about and cast your Plaister upon it, let it stand a little, and when dry, take off your Wall, and cut the Plaister round about the Insect; and taking the

Mould

Mould off the Paper, there will be an opening at the Bottom of the Mould where the Insect laid; turn this Mould and anoint it about the Opening and the Part of the Insect with Oil; then casting some fresh Plaister upon that Place, your Mould will take asunder, and be very convenient to draw out the Ashes of the Insect, after it has been burn'd as is here directed.

Put your Mould upon some warm Wood-Ashes, then cover it with Smallcoal, over the Smallcoal lay Charcoal, and then sling some lighted Smallcoal over them to kindle the others, so that the Heat may be convey'd to the Mould by slow degrees, and after it has glow'd some time, and you think the Insect or Plant is consum'd to Ashes, let it cool of it self with the Fire about it, to hinder the Air coming to it. When your Mould is cold, open the Hole for the Inlet, and either with your breath, or with a little hand Spout that is moist, draw out the Ashes, and your Mould is ready.

You may also burn those Moulds in a Muffle, if you close the Muffle to prevent the Air coming in, and lay the Coals on, and glow it as has been directed. After you have taken out the Mould, put the same in warm Sand, and having your Silver or other Metal ready melted, pour it in quick; but if you cast Silver, sling in the Flux a little *Sal Armoniac* and Borax, mix'd together. After it is cast, let the Mould cool a little, then quench it in Water, and the Plaister will fall off of it self; brush the Silver clean, and Neal and boil it as has been already directed.

*To cast Vegetables or Insects in another Manner.*

**T**IE your Plant, Sprig or Insect with a fine Thread to a little Stick, dip either of them into Brandy, and let it dry a little; temper your Plaister of Paris, prepared as heretofore directed, with Water of *Sal Armoniac*, pretty thin, and dip your Plant or Insect in it all over; then put the little Stick in a Hole against a Wall or any thing else, let it hang free, and in the drying you may display the Leaves of the Plant or the Legs of the Insect as you would have them; and when you have done this hang it in the Coffin; the little Stick may rest on each end of the Coffin; then pouring your Plaister over, you will have an exact Mould; proceed then as directed before.

If

If you will have a small Insect to stand upon a Leaf, then dip the ends of its Legs in Turpentine, and put it on the Plant before you dip it: If it is a Spider or Grasshopper, or any other Insect which you think will be too strong for the Turpentine, kill them first in Wine and Vinegar, and after this put their Legs in the Turpentine, and fix it to the Leaf of the Plant.

*To cast Figures or Medals in Brimstone.*

**M**ELT (in a glaz'd Pipkin) half a pound of Brimstone over a gentle Fire; with this mix half a pound of fine Vermillion, and when you have clear'd the Top, take it off the Fire, stir it well together, and it will dissolve like Oil; then cast it into the Mould, which you first anointed with Oil, let it cool, and take it out; but in case your Figure should change to a yellowish Colour, you only wipe it over with Aqua Fortis, and it will look like the finest Coral.

*How to form and cast all Manner of small Birds, Animals, Frogs, Fish, &c.*

**T**AKE an Earthen, Iron or Tin Ring, which is high and wide enough to hold the Animal you design to Cast, and set the Ring upon a clean Board or Paste-Board; then lay the Animal upon it, and cast the fine Mixture of Plaister pretty thick over it, the rest of the Vacancy you may fill up with a coarser Plaister, even to the Brim: when this is done and pretty well dried, turn your Ring, and putting a little short Stick close to the Body of the Animal, cast a Crust on that Side, to cover that Part which lays close to the Board, and when dry, burn it, and go about the Casting as directed: After you have burn'd or glow'd it thoroughly, you must draw the Ashes out of the Hole which is made by the little Stick, and this you may use for your Inlet.



How



How to Cast Images of *Plaster of Paris*; likewise how to Cast *Wax*, either solid or hollow; also how to form Images in *Wax*, and cast them afterwards in any Metal, either solid or hollow.

**H**OW to prepare the Mixture or the Moulds, has been shewn before, for which Reason it is needless to repeat it here again.

If you will make a Mould to cast an Image or Animal in it, take clean Potters Clay, make thereof a Coffin round about the Image, which you lay long ways on a Board, and anoint over with Oil; then take your fine Plaster of Paris, mix it with Water, and pour it all over the Image, so that it may cover it every where; then give it a stronger Coat with a Coarser Sort, and when the Plaster is dry, take off the Coffin, and cut that Side which is Cast something flat, making some Notches or marks upon it; then turn it, and make a Coffin about it again, and Cast that Side of the Image, after you have anointed it with some Oil all over, so that the whole may be intirely inclos'd.

After the Plaster has been a Day or two upon the Image, it will be quite dry; then with a Wooden Mallet beat cautiously against the Plaster, till a piece thereof loosens, which being taken off the rest will come off easier; and after you have dismantled the whole, anoint the inside thereof with Linseed Oil, with a fine Hair Brush Pencil, and let it dry in; this do twice; and after they have lain two or three Days, cut in an Inlet, where you think most convenient, and when you will cast with Plaster of Paris, before you do it, anoint the inside of the Mould, and after you have put all the Pieces in their proper Places and tied them together, cast your Plaster, and let it stand half a Day; take the Pieces one after another carefully off, in order to keep the Image intire; but if you will cast Wax in that Mould, put only the Moulds for half an Hour before in Water, and the Wax will not stick to it. If you will have the Image hollow, then mind that the Wax be not too hot; pour it into the Mould, and you will easily see how thick it sticks to it: When you think



it is thick enough; then turn your Mould about, and pour out the Wax that's remaining, and after you have for a little while laid it in Water, take off the Pieces of Moulding, and you will have the Image done to Perfection. You must observe, that before you break the Mould from the Image on which you form'd it, you must mark it all over with Crosses, Circles or Strokes, by which you may afterwards fix them right and exactly together to cast in again. If you will have the Wax Figures solid, then let the Mould with the Images lay for half an Hour or more to cool in fair Water.

*To prepare the Wax.*

**T**AKE one pound of white Rosin, that's not greasy, two pound of Wax, melt the Wax; in a Pan, strain it through a Cloth into a glaz'd Pan, and stir it about till it is cool.

*To cast Medals and other Things in Bass Relievo.*

**L**AY your Medal on a clean Piece of Paper or a clean Board, inclose it with a Wall of Clay or Wax, then pour the Plaister of Paris half an Inch thick upon it; when it is dry, take off the Medal, and anoint the Mould with clear Sallet Oil, both within and without, two or three times. If you will cast Plaister of Paris, lay the Mould first for a quarter of an Hour in clear Water; then cast your Plaister as thick as you please.

*N. B.* If you will polish some parts in the Plaister of Paris you have cast, you must do it with Soap Lees, and a Dog's Tooth, or some other smooth Tooth.

You must observe, that whenever you make a Mould of Plaister, let it be for Bass Relievo or Figures, you must always anoint it with Oil, two or three times, which will not only preserve them from the Damage they otherwise would sustain from the Water, but make the cast Pieces come out clear.

*Medals and Figures in Bass relievo, how to cast them like Jaspis.*

**T**O do this, you must have a Hand Spout, or a Glyster-Pipe, at the end whereof fix a Tin or Iron blade, full of round Holes, some larger than others. In this Spout put a Paste, made of fine Chalk, of several Colours; then

then forcing them out in small Shreds of mix'd Colours in one Piece, cut them with a fine edg'd Knife in thin round Slices, and put one into your Mould, pressing it down gently; then pour the Plaister of Paris upon it, and when dry, lay it first over with Fish-Glue, and after that varnish it, and it will be of singular Beauty.

The Colours you may first dilute with Gum-Water, before you mix the Chalk with them.

*Another Method.*

TAKE the above mention'd Chalk-Paste, and after you have mix'd it with a Variety of Colours, as Smalt, White Lead, Vermillion, Red Lead, Masticot, Verdegrease, Brown Red, &c. each Colour made separate into little Cakes, then (with a Rolling Pin) spread it thin like Pyc-Crust, and when you have as many Colours together as you think proper, lay one Leaf upon another, and roll them together from one end to the other, and with a Knife cut thin Wafer-like Pieces; take these and cover your Mould with, press it close down with your Thumb, and pour your Plaister of Paris over it; after it is dry, do it over with Fish-Glue, and then varnish or polish it with a Dog's Tooth.

*To Cast Animals, Fish, Reptiles, Fruit, or any kind of Thing, in a Pewter Plate or Dish.*

TAKE a Pewter Dish that's finish'd, garnish the same with either Fish, Animals, Reptiles, Fruit, Plants, &c. dispose them in proper Order, as your Fancy directs you. Small Animals or Leaves of Plants fasten to the Dish with a little Turpentine, and when every Thing is in Order, wall it round; pour your Plaister of Paris over it, and strike upon the Table the Dish stands on, in order to make the Casting fix the closer about the Things, and after your Mould is dry, make the Mould for the back Part of the Dish; glow it, then fix these Moulds together for Casting, and having tied them round with Wires, and made them red hot, cast your Pewter; and in order not to make the Dish too heavy, convey some little Openings from the back part of the Mould to the Body or Hollow of the Animal, stopping the outside close up again, till your Cast is over, and as soon as you think the Pewter sufficiently struck or fix'd, then open these

these Conveyances and pour out the Pewter which may remain in the Ingot melted.

If you will cast it in Silver, then model your Leaves and Animals, Creatures, &c. each separate and hollow, that they may be soldered on afterwards.

*To cast Figures in Imitation of Ivory.*

**T**AKE Izing-Glass and strong Brandy, and make it into a Paste; then take very fine ground Egg-shells, and mix it together to a Mass: You may give it what Colour you please; but cast it warm into your Mould, after you have oil'd it all over; leave the Figure in the Mould till it is cold; then set it in the Air to dry, and you will have fine Figures, like Ivory.

*Another Mixture to cast Figures, in Bass relieve.*

**T**AKE Flower of Chalk, that has been finely ground, mix it with clear Glue well together, pour it into your Mould, press it with the Palm of your Hand, and it will come out very fine: You may do this in what Colour you please.

*To cast with marbled Colours in Plaister.*

**T**AKE several Colours, as Vermillion, Dutch Pink, Yellow Oaker, Smalt, &c. temper them with Water, and mix every one apart with Plaister: Then take what Colours you please, and first sprinkle your Mould, which is best of Brimstone, with one or more of them, with a little Pencil or Feather; then pour a Colour different, from what you sprinkled, into the Mould, and after it is harden'd, give it a Gloss with Wax or Varnish, as pleases you best.

*A Sand in which one may cast Things to the greatest nicety, whether flat, or in Bass Relievo.*

**T**AKE Fuller's Earth, put it into a Reverberatory Furnace, so long till it is red hot; then take *Sal Armoniac* about one pound, dissolve it in two Quarts of Water; with this Water moisten the burnt Earth, and when cool, put it into the Furnace into a red hot Dish; after it has glown there, take it out again, and after the Heat is a little over, sprinkle it with the Water again, till it is quench'd, then give it

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another Fire, and repeat this five or six times, the more, the better it will receive the Metal: then bring it to a very fine Powder, by grinding it; put it into the Frame, which may be either of Brass, Iron or Wood, but before moisten it a little with the fore-mentioned Water; then make your Impression near the Ingot, and after you have dried it before the Fire, while it is hot, cast your Metal; the Impression will be better the second Time than at first using it, but every time you use it, make it first red hot.

*To make Horn soft.*

**T**AKE one pound of Wood-Ashes, two pound of Quick-Lime, one Quart of Water, let it boil together to one Third; then dip a Feather in it, and if in drawing it out the Plume comes off, it is boil'd enough, if not, let it boil longer; when it is settled, filter it through a Cloath, then put in Shavings or Filings of Horn, let them soak therein three Days, and anointing your Hands first with Oil, work the Horn Shavings into a Mass, and print, mould, or form it in what Shape you please.

*To cast Horn into Moulds.*

**T**AKE Horn Shavings as much as you will, and lay 'em in a new Earthen Pot; take two parts of Wood Ashes, and the third part of Lime, pour clear Lee upon it, so as to cover it all over, boil it well, stir it with an Iron Ladle, till it has the Consistence of a Paste: if you will have it of a Red Colour, then take Red Lead, or Vermillion, as much as you think proper, temper it together; then cast it into a Mould, and let it dry, you may smooth it with a Knife, and it will be of one solid Piece; you may dry it thus of what Colour you will have it.

*To cast Wood in Moulds, as fine as Ivory, of a fragrant smell and in several Colours.*

**T**AKE fine Saw-Dust of Lime-Tree Wood, put it into a clean Pan, tie it close up with Paper, and let it dry by a gentle Heat; then beat it in a Stone Mortar to a fine Flower, sift it through a Cambrick, and lay it, if you don't use it presently, in a dry Place, to keep it from Dust.

Then



Then take one pound of fine Parchment Glue, the finest Dragant and Gum-Arabick, of each four ounces; let it boil in clear Pump Water, and filter it through a clean Rag; then put into it of the said Flower of Wood, stir it till it becomes of the Substance of a thick PASTE, and set it in a glaz'd Pan in a hot Sand, stir it well together and let the rest of the Moisture evaporate till it be fit for Casting. Then pour or mix your Colours with the PASTE, and put in Oil of Cloves, of Roses, or the like, to give it a Scent; you may mix it, if you will, with a little beaten Amber: For a Red Colour, use Brasil Ink, and for other Colours, such as will be directed under the Article for Book-Binders. Your Mould will be better of Pewter or Brass, than of Plaister of Paris; anoint it over with Oil of Almonds, and put your PASTE into it, let it stand three or four Days to dry and harden, then take off your Mould, and it will be as hard as Ivory; you may cut, turn, carve and plain it like other Wood, and be of a sweet Scent; you may also, if your Mould will allow it, use several Colours in one Piece, leaving only in some Part the natural Colour of the Wood, in order to convince the Beholder what it is. It is a fine and curious Experiment.



### Of the Mixture for Casting MIRRORS, and other Things for OPTICKS.

**W**E find the Method for preparing these Mixtures prescribed by several Authors, but after different Ways; wherefore I shall set down only a few which for the Generality are best approv'd of: And First,

**T**AKE three Pound of the best refin'd Pewter, and one Pound of refin'd Copper. First melt the Copper, and then add the Pewter to it; when both are in Fusion, pour it out, and when cold, beat it to Powder: Then strew upon it 12 Ounces of red Tartar, a little calcin'd Tartar, three Ounces of Salt-petre, one Ounce and an half of Alum, and four Ounces of Arsenick. Mix and stir this together, and after it has done evaporating, pour out the Metal into  
your

your Mould; let it cool, and when polish'd, you will have a fine Mirror.

This is the Composition which is commonly call'd the *Steel Mixture*.

Some Artists will have the Arsenick omitted, it being of the Nature to turn the Mirror into a deadish blue Colour, and requires new polishing every Time one wants to use it, and think that Copper and Pewter are sufficient to answer that Purpose.

*Another Method.*

**T**AKE an Earthen Pan, that is not glaz'd, and has stood the Fire; put into it two Pound of Tartar, also the same Weight of Crystalline Arsenick, and melt it on a Coal Fire. When this Mixture begins to smook, put to it 50 Pound of old Copper, and let it be in Fusion six or seven Hours, so that it may be well cleansed. Then add to it 50 pound of Pewter, and let it melt together; after this take up some of the Mixture with an Iron, to see whether it is too hard and brittle; if so, then add a little more Tin, and when you have the right Temper, sling four Ounces of Borax over it, and let it stand in the Furnace till it is dissolv'd; then pour it into your Mould and let it cool; when it is cold, rub it first with Brimstone, and then with Emery; and after the Surface is made smooth and even, polish it with *Tripoli* or Tin Ashes, and give it the finishing Stroke with Lampblack.

*Another.*

**T**AKE Copper one part, Pewter three parts, and a very little Arsenick or Tartar. These put together in Fusion, and let them incorporate.

Some take of the Copper three parts, of Pewter one part, and a little Silver, Antimony, and white Flint.

Others do it with one part of Lead, and two parts of Silver.

After the Metal is form'd and cast, it is requisite to have it smooth and well polish'd: The first is done with Emery, then with Powder of Brimstone or Tin Ashes, or else with *Tripoli*: The Polishing is done with pulverised Chimney Soot (of Wood Fires) and the Ashes of Willow or Cedar,

which will give it a fine Lustre. The Emery is ground to a fine Dust, and moisten'd with Water.

*Another.*

**S**TEEL Mirrors are also made out of one pound of Pewter, and one third of Copper: When these are melted, put into it two Ounces of Tartar, and one Ounce of Orpiment, and when it is evaporated, pour it out into the Mould. The Casting of a flat Mirror or Looking-Glass is done upon a flat Board, which must be made dry and warm, and cover'd with Rosin or Pitch; by this means the Mirror is fix'd to the Board: When cold, rub it off with Sand and Water, then with Emery or Flower of Brimstone, and at last polish it with Tin-Ashes.

*Another Sort of a Steel Mixture.*

**T**AKE good New Copper, of that Sort which is used for Copper Wire, eight parts; fine *English* Pewter, one part; Bismuth five Parts; put it together in a Crucible and melt it. Then grease your Mould all over with Tallow, in order to cast your Metal in it; when it is in Fusion, dip a hot Iron into it, what sticks to it, let cool. If the Colour is inclining to white, it is right; but if to red, you must add some more Pewter, till it has its right Colour. Observe, that whatever you put to the melted Metal, must first be made hot. After this Manner you may form and cast whatever you please.

*Another.*

**M**E L T one pound of Copper, sling into it eight Ounces of *Spalter*, and stir it, when the *Spalter* is in Flame with a Stick or Iron well together, Then add five or six Ounces of fine Pewter to it; pour it into your Moulds, smooth, and polish it as you have been directed before, and you will have a fine and bright Mirror.

*Peter Shot's Metallic Mixture for Mirrors.*

**T**AKE ten parts of Copper, melt it, and add four parts of fine Pewter; strew upon it a small Quantity of

of pulverised Antimony and Sal Armoniac; stir it well together, till the stinking Smoak is evaporated: Then pour it out in the Moulds, and first smooth it with Sand and Water, and then proceed as has been directed.

These Mixtures for Mirrors are made different Ways; the Copper is the chief Ingredient, which must be tempered with a whitish Metal, in order to bring the Objects that are seen therein, to their natural Colour; and this is done by Pewter and Arsenick.

To cast a flat Looking Glass, it will be best to have two flat polish'd Stones for a Mould; between these two Stones put on each End an Iron Wire, as thick as you would cast your Mirror; then tie or screw them close, and fill the Openings round about with Putty, leaving only an Opening to pour the Metal in: When that is dry and made thorough warm, pour the Metal in; and when 'tis cold, smooth and polish it as directed before. You may fasten the one Side to a flat Stone with Plaster of Paris, and polish the other with a smooth Stone; and last of all, give it the finishing Stroke with a Piece of old Hat, and fine Tin Ashes.

If you will caste a Concave Mirror, or Burning Glass, have your Mould turn'd to Perfection; but if you cannot get it conveniently done, you may take a round Ball or Bowl, and proceed thus:

Make a Crust of Wax, roll it with a Roller to what Thickness you would have your Metal cast; and to make it of an Equality, you may fix a couple of Rules on each Side for your Roller to play upon: Then cut this Crust of Wax into a round Circle, and form it close to your Bowl, and set it in a cool Place to harden. In the mean Time prepare a fine Clay, by washing and pouring it out of one Pan into another; take the finest of the Settling, and get it burnt in a Potter's Furnace to a reddish Colour. When this is done, grind it with Sal Armoniac Sublimate and Rain Water, upon a Marmor Stone, very fine, and to such a Consistence, that it may be laid on with a Pencil like Painter's Colour: With this paint the one Side of the Wax Mould over, and let it dry in a Shadow; when dry, lay on a strong Coat of hair'd Clay, of about two Finger's thick, and let this also dry in the Shadow. Then lay the Concave Side uppermost, and do as before: First, with a soft hair'd Pencil paint the prepared



and burnt Clay all over, and when dry, lay it over with hair'd Clay, so as to cover the whole Mould of Wax; the Place where you design to cast your Metal, you may open after it is dry. Then fix the Mould, with the Hole downwards, upon a couple of Iron Bars, or a couple of Bricks, making a Charcoal Fire underneath and round the Sides of it, that the Wax may melt and run out at the Hole: you may catch some of the Wax, and set it by for another Use. When thus the Mould is clear'd of the Wax, and is still hot, turn it up and put warm Sand round about it to the Top, to keep it firm; then put an Earthen-Ware Funnel into the Hole, and pour in the Metal; as soon as you begin to pour, fling into the Metal a little Rag dipp'd in Wax, and whilst it is in Flame, pour it out into your Mould: After the Metal in the Mould is cold, polish it carefully, so as to take no more off in one Place than in another, which, if you do, will prove a Detriment to the Mirror.

The Polishing is best done after the Brasiers Manner, viz. with a Wheel, to which is fix'd a rough Sand Stone, to take off the coarse Crust; then, with a fine Stone and Water, bring it smooth, and with a wooden Wheel, cover'd with Leather, and laid on with Emery, polish it from all the Streaks or Spots, giving it a finishing Stroke with fine Tin-Ashes and Blood Stone, which you lay on to your Wheel, that is covered with Leather: continue this so long till it has a perfect Gloss. Keep it in as dry a Place as possible, to prevent its tarnishing; but if it should tarnish, you must polish it again with a Piece of Buck-Skin, dipp'd in fine wash'd Tin Ashes. After this same Manner you may also polish the Concave Side of the Mirror.

*An uncommon Art of preparing a Mirror Mixture on Brass.*

**T**AKE strong still'd white Wine Vinegar, one pound; fine Sal Armoniac, four Ounces; Quicksilver, four Ounces: Let this boil upon a hot Sand, till the third part of the Vinegar is boil'd away; this Liquid is the principal Ingredient for the Work: Then take a Brass Plate, polish it very bright with some Coal Dust, lay it into an Iron Pan on a gentle Coal Fire, and when it is pretty hot, dip a Rag into this Liquor, and rub your Plate with it for an Hour together; this lays the Foundation for what follows:

Make

Make a PASTE with one part of Quicksilver, and two parts of Soap-Tin; in this dip your Rag, and rub it into the Plate of Brass, so long till you have a Looking-Glass Colour.

These Plates, thus prepared, lay so long in the Iron Pan upon a Coal Fire, till you see they begin to turn to a reddish Colour, which it will do in about a Minutes Time; with this Colour the Mercury flies away, and the Tin Colour remains on the Plate; then let it cool, and take a little prepared Emery upon a piece of Leather, and rub the Plate over with even Strokes, but not too long, for fear of rubbing with the Emery the Tin from the Brass. You may instead of Emery polish it also with *Tripoli*.

N. B. If the Tin should make the Plate too white, you may use Lead instead thereof, making a PASTE with that and Mercury, and proceed as above.

By this Means you may make what Figures you please, and cut them in what Shape you will; you may also use it for many other curious Experiments.

#### To Cast Iron.

TAKE clean Filings of Iron, wash them in Lee, and then in Water; mix them with as much Powder of Sulphur, put it into a Crucible, and give it a strong Fire, till it is in Fusion: If you manage it right, it will cast clean and smooth.

#### To Cast Steel.

TAKE of the best and finest Steel, about one Pound; break it in Bits, put it in a good strong Crucible, and Neal it to a bright red Colour. Then add 16 or 24 Ounces of good common Steel, and Neal it thoroughly: Add then 8 or 10 Ounces of \**Arsenic Glass*, give it a violent Fire, and it will melt and fluviat, with which you may cast what you please.

To

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\* To Prepare the Arsenick: Take one Pound of white Arsenick, two Pound of good and clear Salt-petre; put it in a new Pot, that is not glaz'd, with a Cover that has a little round Hole in the middle; lute it well all round, then let it dry, and when dry, put the Pot in a Reverberatory Fire for three Hours, and there evaporates out of the Hole of the Cover a red

*To Cast Iron as white as Silver.*

**T**AKE Tartar, Salt-petre, Arsenick, and clear Steel Filings, of each an equal Quantity; put it together into a Crucible, on a Charcoal Fire; when in Fusion, pour it out into an Ingot, and you will have out of one Pound of Steel Filings about two or three Ounces of a white bright Mass; clear the Top of the Dross, and preserve the Mass for Use.

*Another Method.*

**T**AKE Tartar, Oil, and a little fix'd Salt-petre, and mix this into a Paste; then put Iron or Steel Filings into a Crucible, set it in a Charcoal Fire, fling the Mixture upon it, and it will dissolve and come out like Silver; but it is brittle, and apt to break.

*Another.*

**T**AKE calcin'd Tartar, and mix it with Oil; of this take two Ounces, Steel-filings six Ounces; put it together into a luted Crucible, and set it in a Wind Furnace, so long, till you think it is melted: Then open the Crucible, and make a fierce Fire, till you see it rise: Take it then off the Fire, clear it from the Dross, and cast it into an Ingot of what Shape you please, and it will be of a white Colour.

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venomous Fume; which you must take Care of, and keep at some Distance from it. The second Hour, move the Fire nearer the Pot, and when the Fumes cease, close the Hole with some Clay: At the third Hour put the Coals close to the Pot, and give it a thorough Heat; then let it cool of itself, and at the opening of the Pot you will find a white, sometimes a greenish white Stone, which put up in a dry warm Place, free from the Air, to prevent its melting: Of this you take five Ounces, and of Borax three Ounces; grind it well together, and let it melt in a large Crucible till it is like Water; pour this in a refining Cup, and you will have a fine transparent Matter: What is not used, you may preserve from the Air, to keep it from dissolving into Water.

*How to Cast Pictures with Ising-glass, on Copper-Plates.*

**T**AKE fine white Isinglass, as much as you please, cut it fine, and put it into a Glass or Cup; pour on it so much Brandy as will just cover the Isinglass; close it well, and let it soak all Night; then pour some clear Water to it, and boil it on a gentle Coal Fire, so long, till when you put a Drop of it on a Knife, it is like a clear crystalline Jelly; strain it then through a Cloth, and put it into a cool Place, where it will turn to a Jelly and be ready for Use.

When you are about casting a Picture, cut so much of the Jelly as you think you have Occasion to cover the Copper Plate; dissolve it in a clean Pipkin, or such like Utenfil, over a slow coal Fire, and mix any of the hereafter mentioned Colours among it: Mean while your Copper Plate must be clean, to rub the Muschel Gold or Silver into the Graving with a Hair Pencil; then wipe the Plate carefully with clean Hands, as the Plate Printers do, and when this is done, pour your dissolved Isinglass over it, but not too hot, spreading it with a fine Pencil very even every where, till your Copper Plate is covered: Set it then in a moderate warm Place to dry; and when you perceive it thorough dry, then, with the Help of a thin Blade of a Knife, you may lift it up from the Plate: If you find the Matter too thin, add more Isinglass to it; but if too thick, add a little more Water.

*Of the Colours fit to be mix'd with the Isinglass, for Casting of Pictures.*

1. **F**OR red, mix with it some of the Liquid in which you have boil'd Scarlet Rags.
2. For Blue, take Litmus dissolv'd in fair Water.
3. For Green, take distill'd Verdegrease, grind it as fine as possible, and mix it with the above Matter.
4. For Yellow, steep Saffron in fair Water.
5. A Gold Colour is made with the above Red and Saffron Yellow.
6. Gold, Silver, or Copper, well ground, as is used for Painting, mix'd with the Matter, and pour'd quickly over the Plate. If you first rub Printers Black in the Graving, the Gold and Silver will look the better.



*To Cast Plaister of Paris on Copper-Plates.*

**F**IRST rub the Colour, either Red, Brown or Black, into the Graving, and wipe the Plate clean; then mix as much Plaister as you think you shall have Occasion for, with fresh Water, to the Substance of a thin Paste, and having put a Border round the Plate of four square pieces of Reglets, pour the Plaister upon, and move it so as to flow even all over the Plate: Let it stand for an Hour, or longer, according to the Dimension of the Plate, and when you find it dry, and turn'd hard, take off the Reglets, and then the Plaster, and you will have a fine Impression of the Copper Graving. You must observe, not to mix more at a time than you have Occasion for, for else it will grow hard before you can use it.

*A Mixture which may be used for to make Impressions of any Kind, and which will grow as hard as Stone.*

**T**AKE clear and fine sifted Ashes, and fine Plaister of Paris, of one as much as the other, and temper it with Gum-Water, or with Size of Parchment; knead it well together, and press it down into your Mould; but do not prepare more than what you use presently, else it will harden under your Hands. You may give it what Colour you please; in mixing it for Black, take Lamp-Black; for Red, Vermillion; for White, Flake-White; for Green, Verdegrease; for Yellow, Dutch-Pinck, &c.

You may instead of Gum or Size, use the White of Eggs, which is more binding.

*To Impress Figures in Imitation of Porcelain.*

**C**ALCINED and fine pulveriz'd Egg-Shells, work'd with Gum-Arabick and the White of Eggs into a Dough, then press'd into a Mould, and dry'd in the Sun, will come out sharp, and look fine.





## PART V.

A Collection of very valuable Secrets, for the Use of SMITHS, CUTLERS, PEWTERERS, BRASIERS, BOOK-BINDERS, JOINERS, TURNERS, JAPANNERS, &c.

### I.

#### Choice Experiments in IRON and STEEL.

*To make Steel out of Iron.*



TAKE small Iron Bars of the finest Sort, powdered Willows or Beech-Coals, the Shavings of Horn, and Soot out of a Baker's Chimney; stratify this in an earthen Pan, made for that Purpose, with a Cover to it. First make a Lay of the Mixture, about an Inch thick; then a Lay of Iron Bars, then again the Mixture, and so proceed, till the Pan is full; the Top must be of the Mixture: then put the Cover upon it, lute it, and put it in a Wind-Furnace for 24 Hours, and give it a reverberatory Fire,

*To harden Sword Blades.*

SWORD Blades are to be tough, so as not to snap or break in pushing against any Thing resistable; they must also be of a keen Edge; wherefore they must along the Middle be hardened with Oil and Butter, to make them tough, and the Edges with such Things as shall be prescrib'd hereafter, for hardening edged Instruments. This Work requires not a little Care in the Practice thereof.

*How*

*How to imitate the Damascan Blades.*

**T**HIS may be done to such a Perfection as not to distinguish them from the real Damascan Blades. First polish your Blade in the best Manner, and finish the same by rubbing it with Flower of Chalk; then take Chalk mixt with Water, and rub it with your Fingers well together in your Hand; with this touch the polish'd Plate, and make such Spots upon as please your self, and set it to dry before the Sun, or a Fire; then take Water in which Tartar has been dissolv'd, and wipe your Blade all over therewith, and those Places that are left clear from Chalk, will change to a black Colour; a little while after wash all off with clear Water, and the Places where the Chalk has been, will be bright; your Watering will be the more perfect, as you imitate it in laying on your Chalk.

*How the Damascan Blades are hardened.*

**T**HE Turks take fresh Goat's Blood, and after they have made their Blades red hot, they quench them therein; this they repeat nine times running, which makes their Blades so hard as to cut Iron.

*To perfume a Sword Blade, so as to retain always an odoriferous Scent.*

**T**AKE eight Grains of Ambergrease, six Grains of the best Bisem, four Grains of right Cibeth; grind this together with a little Sugar-Candy, in a Glass or Agat Mortar; after this add to it four Scruples of the best Benjamin Oil, and mix it well together; then hold the Sword Blade over a gentle, clear Coal Fire, and when the Blade is well heated, dip a little Sponge in the forementioned Mixture, and wipe your Blade all over; this you do only once, and the odoriferous Scent will remain, although the Blade was to be polish'd again.

*A Steel and Iron Hardening, which will withstand and cut common Iron.*

**T**AKE Shoe-Leather, and burn it to Powder, the older the Leather is, the better it is for Use; Salt, which is dissolv'd, and Glass-Gall powder'd, of one as much as the other:  
Then

Then take what you will harden, and wet it with, or lay it in Urin, and taking it out, strew it over with this Powder, or else stratify it therewith in an earthen Pan; give it for five Hours a slow Fire to cement, and make it afterwards red Hot for an Hour together.

*Several other Temperaments for Steel and Iron.*

1.

**I**RON quench'd in distill'd Vinegar, or in distill'd Urin, makes a good Hardening.

2.

Vinegar in which Sal-armoniac has been dissolv'd, gives a good Hardening.

3.

So doth the Water in which Urin, Salt, and Saltpetre has been dissolv'd.

4.

Caput Mortis of Aqua Fortis, boil'd for an Hour in Water, and filter'd through a clean Cloath, makes a tough Hardness.

5.

Saltpetre and Sal-armoniac, of one as much as the other; mix it together, and put it into a Viol with a long Neck, then set it in a damp Place, or Horse-Dung, where it will turn to an oily Water; this Liquid will make Iron Work of an incomparable Temper and Hardness, if quench'd therein, when it is red hot.

6.

A Lee made of Quick-Lime and Salt of Soda, or of Pot-Ashes (filtered through a Linnen Cloath) gives a very good Hardness to Iron, if quenched therein.

7. Dung



7.

Dung of a Creature which eats nothing but Grass, tempered with Water and calcined Soap, and mix'd to a thin Paste, gives a good hardening to Iron, so that it will cut the same Metal that's not harden'd.

8.

Or, take Spanish Reddishes, grate them on a Gridiron, and press the Juice out of it, which gives a good Hardening when Iron or Steel is quench'd therein.

9.

Take the Juice of Nettles, fresh Urin of a Boy, Ox Gall, Salt, and strong Vinegar, of one as much as the other; it gives an incomparable Hardening.

10.

Red hot Iron or Steel, wip'd over with Goose-grease, and then quench'd in sour Beer, takes likewise a good Hardness.

*A particular Secret to harden Arms.*

**M**AKE a Mixture of the following Things, of each an equal Quantity: Take common Salt, Orpiment, burn'd Goats Horn, and Sal Armoniack; powder it, and mix it together; then anoint the Arms with black Soap all over, strew this Powder upon it, and wind a wet Rag about it; lay it in a fierce Charcoal Fire, and let it be thorough red hot; then quench it in Urin. If you repeat it, it will be the better,

*To Temper Steel or Iron, so as to make excellent Knives thereof.*

**T**AKE clean Steel, quench it in five or six times still'd Rain or Worm-Water, and the Juice of Spanish Reddishes; the Knives made of such Steel will cut Iron.

Take black or Spanish Reddishes, grate them on a Gridiron, put Salt and Oil upon them, and let them stand two Days. Then  
press

press the liquor out, and quench the Steel or Iron several times, and it will be very hard.

*To bring Gravers and other Tools to their proper hardness.*

**T**AKE a little Fire Pan with live Coals, and put a couple of old Files, or any other small Bars of Iron over them, then lay your Gravers upon them over a gentle clear Charcoal Fire, and when you see them change to a yellowish Colour, it is a Sign that they are softer; after this Colour they change to a reddish, which shews them still softer; and if you let them turn to a blue, then they are quite soft and unfit for Use: After this Manner you may soften any Steel that's too hard.

*General Rules to be observed in Tempering of Iron or Steel.*

**W**E know by Experience, that the hardening of Iron is perform'd and executed several Ways; for every Operation requires a particular Method of hardening: The Tools that are used for Wood, require a different Temper or Hardness from those used in cutting of Stones or Iron, and therefore are prepared in the several Methods treated of before: An Artist ought therefore to acquaint himself by Practice of the Nature and Quality of the different Ingredients and Liquids that are here prescrib'd, and improve upon such as seem most agreeable: He is to observe the Degrees of Heat, which he is to give, and the length of Time he is to keep the Metal in the Liquid for quenching; for in Case the Iron is made so excessive hot, that it is not capable of receiving any more Heat, it cannot well be quenched, and will all be canker'd; but if it appears of a Saffron or reddish Colour, it is call'd Gold, and is fit to be quench'd for Hardening: However, in this as well as most other Things, Practice is the best Teacher.

*A Curiosity to hammer Iron without Fire, and make it red hot.*

**T**AKE a round Iron, about an Inch thick; at one End thereof fix a round Iron Nob; then begin gently to hammer it under the Nob, turning it quickly round, and by following your Strokes harder and harder, the Iron will heat of itself, and begin to be red hot; the Reason is, because the Nob remains untouch'd, and the heat on each of the Motions cannot dissipate.

*To*

*To soften Iron or Steel that's brittle.*

1.

**A**NOINT it with Tallow all over, neal it in a gentle Charcoal Fire, and let it cool of itself.

2.

To neal it thus with human Excrement, softens it; but you must keep it in the Fire for two Hours.

3.

Or, take a little Clay, Lime, and Cows Dung, cover your Iron therewith, and neal it in a Charcoal Fire: Then let it cool of itself.

4.

Or, make Iron or Steel red hot, and strew upon it good Hellebore, and it will become so soft that you may bend it which way you please: This is very useful for those who cut in Iron or Steel.

5.

Take Lead, put it into a Crucible, or Iron Ladle, and melt and pour it into Oil; this repeat seven times running. If you afterwards quench Iron or Steel in this Oil, it will be very soft; and after you have shap'd or work'd it in what you design'd it, you may harden it again by quenching it in the Juice of Onions.

6.

Take Lime, Brick-Dust, and Venice Soap; with this anoint your Steel and neal it; then let it cool of itself.

7.

Take the Root of blue Lillies, cut it fine, infuse it in Wine, and quench the Steel in it.

8. Wind

8.

Wind about the Steel some thin Slices of Bacon, and over that put Clay, let it neal for an Hour, and the Steel will be very soft.

9.

Take Quick-Lime and pulverized Soap, of one as much as the other, mix it together, and temper it with Ox's Blood; with this anoint the Steel; then lay a covering of Clay over it, and let it neal and cool of it self.

10.

Take the Juice or Water of common Beans, quench your Iron or Steel in it, and it will be as soft as Lead.

*A particular Powder and Oil, to take off the Rust and Spots of Iron, and to preserve it from Rust for a long Time, very useful in Armouries.*

**T**AKE 32 Ounces Crucible Powder, of such as is commonly used for refining of Silver, and sift it through a fine Hair Sieve: Then take 64 Ounces of Emory, and one pound of Silver Oar, pound it all very fine, and sift it; put at last fine beaten Scales of Iron to it, and the Powder is ready.

*To prepare the Oil for it.*

**T**AKE three pound of *Lucca* Oil, and put it into a Copper Bason or Pot; then take three pound of Lead, melted, and pour it into the Oil, take it out, and melt it again, and repeat melting and pouring several times; the more, the better the Oil will be. After you have done this, and the Heat of the Lead has extracted both the Greasiness and Salt of the Oil, take the Lead out, and put the Oil into a Glass; fling three pound of Filings of Lead into it, shake it well together; pour it afterwards on a Colour Stone, grind it together as Painters do their Colours, put it again into the Glass, to preserve it for Use: The Lead will sink to the Bottom, and the Oil swim a top, which you may use in the following Manner.

Take

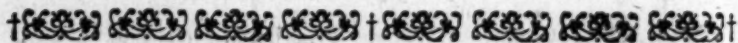


Take some of it in a bit of Cloath, on which there is some of the before-mentioned Powder, and rub the Moles or Spots upon Armour or any other Iron Work therewith, and it will take them clean off; and if afterwards you anoint the Arms or Iron Work with the clear Oil, it will keep it from Rust for a long Time.

*N. B.* The Emory which is used among the other Ingredients of the Powder, must be first calcined, which you do thus: Lay it on a Coal Fire, and when you see it of a red Colour, take it out and beat it in a Mortar, and it is fit to be mixt in the Rust-Powder.

*Another Method.*

**F**RY a middling Eel in an Iron Pan, and when brown and thoroughly fry'd, press the Oil thereof out, and put it into a Phial, to settle and become clear, in the Sun. Iron Work, anointed with this Oil, will never rust, although it lay in a damp Place.



To etch upon IRON-BLADES, either in ARMORY,  
or SWORD and KNIFE-BLADES.

*To prepare the Etch Water.*

**T**AKE Mercury and Aqua-Fortis, put it together into a Glass, till the Mercury is devoured, and it is fit for Use.

*To make the Ground.*

**T**AKE three Ounces Red Lead, one Ounce White Lead, half an Ounce of Chalk, all finely pounded; grind this together with Varnish, and anoint your Iron therewith; let it dry in the Sun, or before a slow Fire, and with a pointed Steel or Needle draw or write in it what you please, and then etch it with the above prepared Water.

*Another*

*Another Water to etch with.*

**T**AKE two ounces of Verdegrease, one ounce of burn'd Alum, and one ounce of Salt, which is dissolv'd; boil this in one Quart of Vinegar, till it is half boil'd away, and when you are ready to etch, warm it, and pour it with a Spoon or Glass Cup over your Work; hold it over the Fire to keep it warm, and repeat this till you find it etch'd deep enough.

*To etch 100 or more Knife Blades at once.*

**G**RIND Red Lead with Linseed Oil or Varnish; with this wipe your Blades all over, and let it well dry and harden; then write or draw with a pointed Bodkin whatever you will; then put them at some Distance from each other, into a Glass or well glaz'd Pot or Pan; dissolve some Vitriol in hot Water, pour it over the Blades, and lute the Glass or Pot; set it over a gentle Coal Fire, let it boil for some time, and then cool; then take your Blades out, scrape the Red Lead off, and you will find the Etching to your Satisfaction.

*To make blue Letters on Scimeters or Sword-Blades.*

**T**AKE the Blade, hold it over a Charcoal Fire till it is blue, then, with Oil Colours write what Letters you will upon the Blade, and let it dry; when dry, take good strong Vinegar, make it warm, and pour it all over the Blade, which will take off the blue Colour; then wet your Oil Colour with fresh Water, and it will come off easily, and the Letters drawn therewith, remain blue.

*To harden Fishing Hooks.*

**A**FTER you have (out of good Wire) made your small fishing Hooks, you must not put them into the Fire to harden, but lay them upon a red hot Iron Plate, and when they are turn'd red, fling them into Water; take them out again, and when dry, put them again on the hot Iron Plate, and when they appear of an Ash-Colour, fling them again in cold Water; this will make them tough, otherwise they will be brittle.

*To gild upon Iron or Steel.*

**T**AKE common Salt, Saltpetre and Alum, of one as much as the other, dissolve it in as little a Quantity of warm Water as possible; then filter it through a whited brown Paper, put Leaf Gold, or rather thin beaten Gold to it, and set it in hot Sand, to make it almost boiling hot; keep it in that heat for 24 Hours, and if the Water evaporates, you may supply it with more; but at last let it all evaporate, and it will turn to a yellow Salt; this pulverize; put it into a Glafs, and cover it with strong Brandy, or Spirit of Wine, two Inches high above the Powder: Then stop your Glafs close, put it into a gentle Warmth, and the Brandy or Spirit will extract all the Gold, and be of a beautiful Colour. With this Water you may, with a new Pen or Pencil, write or draw what you please, upon a Sword-Blade, Knife, or any other Thing made of Iron or Steel, and it will be gilded to a high Colour.

*A Ground for Gilding Steel or Iron.*

**T**AKE five Ounces of Vitriol, two Ounces of Galiz-Stone, two Ounces of Sal Armoniac, one Ounce of Feather-White, and a Handful of common Salt; beat all this together till it is fine, and mix it well; put it into a glaz'd Pipkin, add to it a Quart of Water, and give it a quick boiling; then take a Knife, or any other Iron that is clean, and stir it about; if it is of a Copper Colour, it is right; but if of a Red Colour, it is better.

If you have a Mind to gild with this Ground, put your Steel on a slow Fire, and make it so hot that you can't bear it on your Hand; then take your Ground, and dipping some Cotton into it, wipe the Steel with it; take afterwards Quick-silver, and wipe your Ground over; then take the prepared Gold, and lay it on such Places as you would have gilded; After you have done this, lay it on a Charcoal Fire, till it turns yellow; then wipe it over with Tallow, and take Cotton to wipe your Blade, holding it all the while over the Fire, till it inclines to a black; rub it with a woolen Cloath, till that Colour vanishes, and rub it again with Chalk, till you bring it to a fine Gloss. If you will have the Ground brown

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brown or blue, hold it over the Fire, till it turns either to the one or the other Colour; then wipe it over with Wax, and polish it with Chalk.



## II.

## Of LEAD and PEWTER.

*To make Pewter hard.*

**T**AKE one Pound, or what Quantity you please, of Pewter, and let it melt in an Iron Pan; add to it some Salet Oil, let it well evaporate, and stir it continually, keeping the Flame from it; put to this some fine Wheat Flower, and stir it well about; then take all the burn'd Matter off the Top, and to each Pound of Tin add three or four Ounces of Plate Brass, cut in small Pieces, mix'd with Oil, and a few Ounces of pulveriz'd Bismouth, or Regul of Antimony; stir it all the while, and when all is melted and incorporated, you will not only have a Pewter that's harder and whiter, but also different in its Sound from common Pewter.

*Another Method.*

**M**ELT Tin in an Iron Pan, strew Colophorni or Rosin, with fine Wheat Flower mix'd together, into it, and stir it gently about: This takes off the Blackness, and makes it of a fine white Colour.

If you will have it hard, add to each Pound of Tin one or two Ounces of pulveriz'd Regulus of Antimony and Veneris; this makes it white, hard, and of a clear Sound.

*Another Method to make Pewter as white as Silver.*

**T**AKE clean Copper one Pound, and let it fluxuate; add to it of the best English Pewter one Pound, and continue the Flux; to this add two Pound of Regulus Antimony and Martis, and let it still fluxuate for Half an Hour; then cast it into an Ingot. Beat this in a Mortar to a fine Powder, and sling thereof



thereof as much into the melted Tin as you think requisite: You will find (after you cast it) of a fine Silver Colour, it will be hard, and give a fine Sound: To make it fluviat the better, you may add a little Bismuth.

*Another Method.*

**M**ELT one Pound of Copper, add to it one Pound of Tin, half a Pound of Zink, one Pound of *Reg. Antim.* and *Martis*; let it fluviat Half an Hour, and cast it into an Ingot.

*N. B.* The German Author says, there are many more Secrets relating to whitening and hardening of Pewter, but thinks it not proper to divulge them; and adds, that he has found by Experience, that the *Reg. Antim.* and *Veneris* is better for that Use, than the *Reg. Antim.* and *Martis*; because the last will turn the Pewter in time to a dirty Blue; whereas the former will make it continue white, hard, and of a good Sound.

*To make Tin or Lead Ashes.*

**T**AKE which Sort of these Metals you will, let it melt, and sling well dry'd and beaten Salt into it, stir it well together with an Iron Ladle or Spatula, till it separates, and forms itself into a Powder.

*Or,*

**A**FTER the Tin or Lead is melted, pour it into fine dry Salt, stir it together till it is fit for sifting: Then put this Powder into a Pan of clean Water, and stir it; pour off the first Water, and put fresh to it; repeat this so often till the Water comes off clear, and without the Taste of any Salt. The remaining Powder put into a melting Pot, set it in a reverberatory Furnace, stir it well together, and you will have fine white Tin-Ashes.

*A Water to Tin all Sorts of Metals, but especially Iron.*

**T**AKE one Ounce of fine pounded Sal Armoniac, and put it into very four Vinegar, and when you will tin Iron, wash it first with this Vinegar, and strew beaten Rosin over it,

it; dip it into the melted Tin, and it will come out with a fine and bright Lustre.

*A Gold Colour upon Lead or Tin.*

**T**AKE Saffron, as much as you will, and put it into strong Gum-Water; add to it a third Part of Vinegar, and let it soak over Night; then mix it with a little clarified Honey, stir it well together, and let it boil till it comes to the Substance of Honey; strain it afterwards through a Cloath, and it is ready for Use.

*Another.*

**T**AKE Linseed Oil, which is skimm'd over the Fire, and put Amber and Aloepatica in, of one as much as the other; set it over a Fire, and stir it till it is thick; then cover it all over with Earth for three Days: If you anoint your Tin or Pewter therewith, it will have a fine Gold Colour.

*To make Tin which has the Weight, Hardness, Sound, and Colour of Silver.*

**T**AKE fine long Crystal Antimony, beat it fine, and wash it in Water till it becomes sleek, and let it dry again. Then take well dry'd Salt-petre and Tartar, of each an equal Quantity, beat it fine, and put it together into an earthen Pan, on which lay some live Charcoal, and the Salt-petre and Tartar will soon begin to fulminate: Then cover the Pan with a Lid, let the Matter burn out and cool, and you will find a yellow Salt: This Salt beat to Powder before it is quite cold, and put thereof into a Crucible one Pound, and of the wash'd Antimony two Pound. Mix it well together, and let it fluviat in a Wind Furnace for three quarters of an Hour: Then sling a few lighted Smalcoals in it, let them consume, and stir it with a Stick well together. Presently after take the Crucible out of the Fire, beat it a little down to the Bottom, and let it cool of itself; then break the Crucible, and you will find a Silver-colour'd Regulus, of three quarters of a Pound Weight.

Take then two Pound of old Copper, cut it fine, Neal it, and quench it, ten times running, in very strong Lee, made of the above Tartar and Rain Water. Take

it, while wet, and put it into a Crucible, with one Pound of fine beaten Arsenick, *stratum super stratum*. When all is in the Crucible, pour as much Lindseed Oil on it as will cover the Matter; then cover and lute your Crucible, put it into a new Pan, fill it all round with Sand, and set it three Hours in a Circle Fire: After it is cold, open it, and you will find the Copper to be spongy and of several Colours. Of this take two Pound, and Plate Brass two Pound, melt these together; add by degrees the Copper, and give it a quick Fusion in a Wind Furnace: Then add two Pound of *English Pewter*, half a Pound of Bismuth, and two Pound of the above Regulus; let it well fluxuate, then pour it out, and you will have a fine Silver Mixture. This beat into a fine Powder, mix it with Lindseed Oil to a Paste, and with a Spatula add it to the melted Pewter: Stir it well together, and you will have a fine Tin, which will resemble the Silver in every Thing, except the Test.

*To make Tin flow easy.*

**T**AKE Rosin and Salt-petre, of each an equal Quantity, bear it to Powder, and strew it upon the Tin when it is in Fusion.

*A particular Method to make Tin resemble Silver.*

**M**ELT four ounces of fine Plate Brass, add to it four ounces of fine clean Tin, and when it is in Fusion, add four ounces of Bismuth, and four ounces *Reg. Antim.* let this fluxuate together, and pour it out to an Ingot; then beat it to Powder, grind it with Rosin and a little Sal Armoniac, and with Turpentine form it into Balls; let them dry in the Air, and when you will use them, beat them fine, strew the Powder thereof upon the melted Tin, stir it well together, and continue putting the powder'd Balls upon the Tin, till you perceive it white and hard enough: Of this Tin you may draw Wire for Hilts of Swords, or make Buttons, it will always keep its Silver Colour.

*A Solder to Solder Tin with.*

**T**AKE Tin and Lead, of each one Ounce; Bismuth two Ounces; this melt, and pour it over a Plate to cast it thin: With this you may solder over a Candle or a small Charcoal Fire.

*Another*

*Another Solder for Pewter.*

**T**AKE Rosin and Oil, let it melt in a Spoon, and fling into it a little Devil's Dung, then pour it out; and having new fil'd the two broken Pieces, anoint them with the Rosin, dust some fine fil'd Tin over it, and hold it over a Coal Fire, and when it flows, take it off and let it cool.

*To make Tin Coat-Buttons, in Imitation of Work'd Buttons of Gold and Silk.*

**T**AKE Lampblack, grind it with Oil of Spike, and mark the ground Work with a Pencil; when dry, draw it all over with the Varnish before describ'd: The best Way to imitate worked Buttons is, to do them in a fine Mould, either stamp'd or cast, the Ground being first fill'd up with Black, Blue, Red or any other Colour, then the raised part wip'd very clean, and when dry, drawn over with the Varnish, which will make it look much finer than what can be done upon a plain Button.

For a Brown Colour, take *Umber*.

For Green, take still'd Verdigrease, mix'd with other Colours, to make it deeper or lighter.

For Gray, take white Lead and Lampblack.

All your Colours must be ground with Oil of Spike.

In this manner you may embellish some Pewter with a Coat of Arms, a Cypher, or Ornaments; I mean such Pewter Things that are not scour'd.

*To gild upon Tin, Pewter, or Lead.*

**T**AKE Varnish of Linseed Oil, Red Lead, White Lead, and Turpentine; put it together in a clean Pipkin, and let it boil; then grind it upon a Stone, and when you will gild Pewter, take a Pencil, draw the Liquid thin upon what you will gild, and lay your Leaf Gold upon it; or instead of that, Augsburg Metal, and press it with Cotton, to lie close.

*Another Method to gild Pewter or Lead.*

**T**AKE the White of an Egg, and beat it clear; with this wipe your Tin or Pewter, which must be first warm'd before a gentle



Fire, in such Places as you design to gild; lay on your Leaf Gold quick, and press it down with Cotton.

The Juice of Nettles is also fit for that Use, and rather better than the Egg clear.

*Another Method to gild Pewter.*

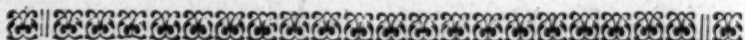
**T**AKE Leaves of Staniol, and grind them with common Gold Size; with this wipe your Pewter or Lead over; lay on your Leaf Gold, and press it with Cotton: It is a fine Gilding, and has a beautiful Lustre.

*A Method to gild with Pewter, or Lead Leaves.*

**T**HIS may be done several ways, but the best is, to take White Lead, ground with Nut-Oil; with this lay your Ground on what you design to gild, let it be Wood or any Thing else; then lay on your gilded Tin Leaves, press them down with Cotton, or a fine Rag, and let it dry; when dry, polish it with a Horse's Tooth or Polisher, and it will look as if it had been gilded in Fire.

*To gild Lead.*

**T**AKE two Pound of Yellow Oaker, half a Pound of Red Lead, and one Ounce of Varnish; with which grind your Oaker, but the Red Lead grind with Oil, and temper them both together; lay your Ground with this upon the Lead, and when it is almost dry, lay on your Gold, let it be thorough dry, then polish it.



III.

Some Experiments relating to COPPER and BRASS.

*To melt Copper and Brass, and give it a quick Fusion.*

**T**AKE Saltpetre, Tartar, and Salt, beat it together very fine; when you see that your Metal begins to sink with the Heat, fling a little of this Powder into it, and when melted, fling again a little into it, and  
after

after you see it in Fusion, like Water, fling a little again, the third time: To 25 pound of Metal fling about a Walnut full of Powder, and your Copper or Brass will cast easy, and be of a malleable Temper.

*To make Brass malleable that's Brittle, and apt to rent in the working of it.*

**T**AKE Tartar, Saltpetre, and Sulphur, pulverise it together, and after you have made your Brass red hot, strew it all over it, and let it cool of it self.

*A Solder for Brass.*

**T**AKE one Grain and a quarter of Silver, three Ounces of Brass, one Ounce of Zink, and melt it together; when melted, fling a good quantity of Venice Borax upon it.

*To make Copper as white as Silver.*

**P**UT your Copper in a strong melting Pot, in the midst of a Quantity of Glass, and set it in a Glass Furnace to melt; let the Copper be all over cover'd with Glass, and the Glass will contract the Greenness of the Copper, and make it look white. If you repeat this several times, your Copper will be the whiter.

*Another Way.*

**T**AKE old Copper, that has been much used, or been long in the open Air and Weather; melt it in a strong Crucible before a Smith's Forge, or in a Wind Furnace, but take Care of the Smoak; let it melt a Quarter of an Hour, or longer, and clear it from the Scales that swim a-top: Then pour it through a Wisk or Birtch Broom into a sharp Lee, made either of Quick-Lime and Wine-Branch-Ashes, or of Salt of Tartar, or *Caput Mortis* of distill'd Spirit of Nitre, or such like, and the Copper will come fine and nice: Then take it out of the Lee, and let it melt again as before: Repeat this four Times running, in order to purify the Copper, and when the Copper is well purified, melt it over again; when it is in Fusion, fling two Ounces of Crystalline Arsenick in, by little and little; but take Care of the Smoak, and

tie

tie a Handkerchief, moistened with Milk, about your Mouth and Nose: After it has evaporated, or rather before it is quite done, sling into it two Ounces of Silver; and when that is melted, granulate it again through a Wisk, and melt it again for Use. It will be fit to make any Thing in Imitation of Silver.

*Another.*

**T**AKE white Arsenick half a Pound, Salt-peter eight Ounces, Tartar eight Ounces, Borax four Ounces, Glafs-Gall four Ounces; pulverize each very fine, then mix and put them together in a Crucible, and let it fluxuate in a Wind-Furnace for an Hour or more; then pour it out, and you will have a whitish yellow Substance.

Then take one Part of old Copper, and one Part of old hammer'd Brass, both cut in small Pieces; Neal these well, and quench them in a Lee made of a Quart of Urine, an Handful of Salt, four Ounces of white powder'd Tartar, and two Ounces of Alum: Boil it up together, and repeat it 10 or 12 Times.

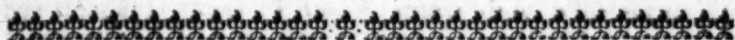
When thus you have cleansed the Copper and Brass, put it together in a Crucible, and give it a strong Fire in a Wind-Furnace, or before a Smith's Forge; let it well fluxuate, and then sling of the above Composition (which must be pulverised) one Spatulo full after another into the Crucible, stirring it sometimes about with a Stick; to one Ounce of Copper you take an Ounce and half of Powder: When all is infused and incorporated, then sling a few Pieces of broken Crown Glafs into it, and let it melt; then draw it out again with a Pair of Tongs, and sling *Sal Armoniack* into it, of the Bigness of a Wal nut, and when it is in thorough Fusion, pour it out into a Casting Pot, and your Copper will be of a fine White.

If you take of this Copper 24 Ounces, and melt one Ounce of Silver among it, letting it well fluxuate with *Sal Armoniac*, you will have a fine Mass, which may be work'd what Shape, or into any Utensil you please, and it will hardly be distinguish'd from real Silver Plate.

When the Silversmith works this Composition, he must observe always, when melting, to sling some *Sal Armoniack* into it, to make it malleable: And in hammering he must

must often Neal it, and let it cool of it self; then hammer it gently, till it is as thin as he would have it; for if it is beat quick in the Beginning, it will be apt to crack.

The more this Metal is Neal'd and gently hammer'd, the better it will be. When the Work is done, Neal it; then rubbing it with Charcoal, and boiling it afterwards three times in a strong Lee of Tartar, your Work will be like Silver.



## IV.

## Choice Secrets for BOOK-BINDERS.

*To prepare a Lack Varnish for Book-binders, for French Bindings.*

**F**IRST, when the Book is cover'd, either with Calf or Sheep Skin, or with Parchment, it is struck over with a Varnish, and spotted with such Colours as are taught under the Article of imitating Tortoises on Ivory or Horn: Some will spot the Leather before they lay on the Varnish, and after they have sprinkled their Colour (which they commonly make of Umber) they lay the Varnish over, and polish it with a Steel Polisher, after which they give it one Lay of Varnish more, which is the finishing Stroke.

*French Leather for Binding of Books.*

**M**AKE Choice of such Leather that's wrought smooth and fine, and strain it on a Frame; then having your Colours ready at Hand, take first of one Sort in a Pencil made of Hogs Bristles, and with your Finger sprinkle the Colour out thereof upon the Leather; and when you have done with one, you may take another Colour, and proceed with as many Colours as you think proper: If you will imitate a Tyger's Skin, you dot your Colours upon the Leather with a Stick that's rough at the End, or a Pencil; and after it is well dry'd, you lay it over with a *Spanish* Varnish, which you make in the following Manner: Take



Take a Pint of high rectified Spirit of Wine, of clear Gum *Sandarac* four Ounces, clear Oil of Spike one Ounce; pound the *Sandarac*, and put it in the Spirit of Wine, and then into the Oil of Spike; let it stand till it is dissolv'd and settled.

*To prepare Parchment that resembles Jaspis or Marmor.*

**H**AVE a Trough, made in the Nature as will be directed under the Article of making Marbled Paper; let it be fill'd with warm Water of Gum Tragant, and having your Colours ready prepar'd (as will be directed) stir the Gum Water with a Stick, and bring it to a quick circular Motion: In the Interim dip your Pencil with Colour in the Center thereof, the Colour will disperse and form it self in Rounds, as it is carried by the Motion of the Water: Then stir it round in another Place, and with a different Colour proceed as you did with the first, till your Trough is covered with Varieties of Colours. When all is ready, and the Water smooth and without Motion, then lay on your Parchment (which before has been laid between damp Paper or Cloaths) and proceed therewith as you do with the marbled Paper; hang it up to dry, then smooth and glaze it, in the Manner you do colour'd Parchment.

*A Green transparent Parchment.*

**W**ASH the Parchment in cold Lee, so long till it comes clear from it, then squeeze out the Wet as much as possible, and if you will have it of a fine green Colour, take still'd Verdigrease, ground with Vinegar, and add a little Sap-Green to it, temper it neither too thick nor too thin; then soak your Parchment with this Colour thoroughly, a whole Night; rinse it afterwards in Water; strain it immediately on a Frame, and set it to dry; then take clear Varnish, lay it on both Sides; set it in the Sun to dry; after this cut the Parchment out of the Frame into Leaves, as large as you please, and lay them in a Book under a Press, to keep it fine and streight: The Virtue of this Parchment is, that it magnifies a small Letter, when put over it, as big again; and is a great Preserver of the Eyes, to those who read much by Candle Light.

The

The Varnish must be prepared of Linseed Oil, and boiled in Frankincense, *Mastick* and *Sandarac*.

If you will have the Parchment of a clear, transparent, and white Colour, you only wash, strain, and varnish it, as above.

If you will colour it yellow, steep your Parchment, after it has been wash'd, in a yellow Liquid, made of Saffron; for which purpose tie Saffron in a thin Linnen Rag, hang it in a weak Lee, and let it warm over a slow Fire, and when you see the Lee tinctur'd yellow, it is fit for Use.

*For transparent Red,*

**T**AKE Brasil, as much as you will, put it in a hot Lee, which is clear, and not too strong, and it will tincture the Lee of a fine red; then pour in about half an Egg-shell full of clear Wine, draw the Parchment through the Colour, and when it is as deep as you would have it, strain it, as before.

*For a Blue,*

**T**AKE *Lombard* Indigo, grind it with Vinegar on a Stone, and mix *Sal Armoniac* among it, to the Quantity of a Pea, with this wet your Parchment, and proceed as has been directed for the Green.

*For a Violet or Purple.*

**T**EMPER two thirds of the above red, and one third of the blue, and use it as before directed.

*For a Black Colour.*

**T**AKE Roman Alum, beat it to Powder, and boil it in Rain-Water, till a fourth Part is boil'd away; then add Roman Vitriol or Atrament, with some Roman Gall, and boil it together; with this stain your Parchment twice or three times over, and when dry, lay the *Spanish* Varnish over it.

*N. B.* With these transparent Parchments you may make curious Bindings; one Sort, used at *Rome*, is made thus: Lay the Board or Paste-board over with Leaf Gold, Leaf Silver, Stagniol, Metal Leaves, &c. Then binding the Parchment over it, it will give it an uncommon Lustre and Beauty.

*To make red Brasil Ink.*

**Y**OU must first observe, that when you boil Brasil for Ink, you ought to do it when the Weather is fair, and the Sky without Clouds or Wind, or else your Ink will not be so good.

Take Quick-Lime, pour Rain-Water on it, and let it stand over Night. In the Morning pour the clear from off the Top, through a Cloath; and to a Quart of this Water take one Pound of Brasil Shavings; let them boil half away, and put to it two Ounces of Cherry Gum, one Ounce of Gum Arabick, and one Ounce of beaten Alum; then take it, when all is dissolv'd, from the Fire; pour it off the shavings, and put it up for use; you may also add to it a little clear Chalk.

*To prepare Brasil Ink without Fire.*

**T**AKE a new glaz'd Pipkin, in which put two handfuls of Brasil Shavings; pour half a Pint of Vinegar on it, and let it stand over Night; then put to it half an Eggshell full of Alum, with a little Gum; take also Chalk, scrap'd fine, about an Eggshell full, or more, put it gently by little and little into the Pipkin, and stir it well together with a Strick, and it will begin to boil, as if it was upon the Fire: You must set your Pipkin in a clean Earthen Dish, before you put your Chalk in; for as soon as the Chalk is in, it will boil over, and you cannot hinder it; when this Ebullition is over, then put it again into the Pipkin, let it stand a Day and a Night, and you will have a fine Brasil Ink.

*To prepare Brasil Ink in Sticks.*

**T**AKE Brasil Shavings, or Chips, put them in a Pan, and proceed in every respect as directed in the foregoing. After the Brasil is thus made fit for Writing, pour it into Shells, and set it in the Sun, where no dust can come to it, to stand a full Hour; Then take other Shells, pour the Top of the Brasil out of the first Shells into them, and fling the settling away; set these Shells also in the Sun, and after they have stood an Hour, proceed as before; this do so long till it is quite purified; then boil it as dry as Wax,  
put

put it up into a Nut-shell, or in a piece of Parchment, and you may dilute it with a little Wine or fair Water, in a little Cup, as much as you have occasion for, and write or paint therewith; it is a fine Colour, and very fit for Colouring Maps or Prints.

By mixing the Brasil Ink with a little ground Indigo, you have a Crimson or Purple; and if with a little white Lead, you will have a Rose Colour.

*To prepare or extract all manner of Lakes out of Flowers.*

**T**AKE Flowers, of what Sort or what Colour you will; if they stain white Paper, when rubb'd against it, they are good: With these Flowers fill a common, but large Head, upon a common cucurbit, that's fill'd with Aqua Vitæ; put a receiver to it, and lute it well; then still it over a gentle Fire, and the subtil parts of the Spirits will fly up into the Head, extract the Tincture out of the Flowers and Herbs, and fall into the Receiver. This colour'd Spirit, if distill'd in another Still, will pass without any Colour, and may be used again for the like Purposes; but the Tincture or Colour will remain at the Bottom of the Still, which you take out and dry at a gentle warmth: In this Manner you may make the best Lake fit for Painters use.

*Directions for Extracting all Sorts of Colours out of Wood, Flowers and Herbs.*

**W**HEN Mariners are sent in search of Dyers Drugs, Wood, or Plants, they are advised by the Merchants to try these Commodities by chewing them, and see whether they colour the Spittle, which if they do, it is a Sign they are good, and such Tryals may also be made on white Paper or Linnen.

The Drugs or Plants that are known to be good for Extraction of Colours, are among many others these, *Lignum Nephriticum*, or *Fusticks*, is good for yellow and green Colour, *Compeiana* and *Sylvestre*, &c.



*To gild Paper.*

**T**AKE yellow Oker, grind it with Rain Water, and lay a Ground with it upon the Paper all over, when dry; then take the White of Eggs, beat it clear with White Sugar-Candy, and strike it all over; then lay on the Leaf Gold, and when dry, polish it with a Tooth.

Some take Saffron, boil it in Water, and dissolve a little Gum with it; then strike it over the Paper; lay on the Gold, and when dry polish it.

*To prepare Blue Ink.*

**T**AKE Elderberries, press the Juice thereof into a Glafs, and put powder'd Alum into it; add to it about the Quarter Part of it of Vinegar, and a little Urin; then dip a Rag into it, and try whether the Colour is to your liking; you may if it is too pale, add a little more of the Juice; and if too dark, of the Vinegar to it.

*To make good Writing Ink.*

**I**T must first be observed, that according to the Quantity of Ink you design to make, the Weight and Measure of the Ingredients must be either augmented or lessen'd: Thus for Example: If you would make 10 Quarts of Ink, you ought to take four Quarts of Water; six Quarts of White Wine Vinegar; three Quarts of White Wine, and proportion the rest by Weight accordingly.

*Good Ink for Paper.*

**T**AKE one Pint of Water, one Pint and a half of Wine, one Pint and a half of White Wine Vinegar, and mix it all together; then take six Ounces of Galls powdered and sifted thro' a fine Hair Sieve, put it in a Pot or Bottle by itself, and pour on it one half of your mix'd Liquor; take also four Ounces of Vitriol powdered, put it into a Bottle by itself, and pour half the remaining Liquor upon it: To the rest of the Liquor put four Ounces of Gum-Arabick, beaten fine; cover these three Pans, or Pots, or Bottles, let them stand three Days, and stir every one of 'em three or four times a Day; on the fifth Day put the Pan with the Galls upon the Fire,

Fire, and when you see that it is most ready to boil, keep the Gall down, and whilst it is warm, pour it into another Vessel through a Cloath; don't squeeze or wring the Cloath, but let it go through of itself; then add the Liquor which is in the two other Vessels to it, stir it well together, let it stand three Days, stirring it every now and then; the fourth Day, after it is settled, pour it through a Cloath into a Jar or Bottle, and you will have good Writing Ink.

*Ink for Parchment,*

**I**S prepared in the self same Manner as the foregoing Receipt directs, only to a Pint of Water, take half a Pint of Wine and half a Pint of Vinegar, which together will make one Quart of Ink.

*Another.*

**T**AKE three or four Ounces of powder'd Galls, and three or four Ounces of Gum Arabick, put it together in a Vessel with Rain Water, and when the Gum is dissolv'd, then strain it through a Cloath, and add to it near half an Ounce of powder'd Vitriol.

*Another.*

**T**AKE one Pint of Beer, put in it one Ounce of powder'd Gall, let it boil till you see it of a reddish Colour: Then add six Drams of green Vitriol powder'd to it, and let it boil again; when you take it off the Fire, add six Drams of Gum-Arabick, and of Alum the Bigness of a Pea, both powder'd; stir it till it is cold.

*Another Receipt for Writing Ink.*

**T**AKE five Ounces of Gall, six Ounces of Vitriol, four Ounces of Gum, and a fresh Egg, a little Powder of Walnuts, two Gallons of Beer, and put it into an Earthen Pot; add a little *Sab Armoniac*, to keep it from moulding.

*Another.*

**T**AKE for one Quart of Ink, one Pint and half a Quarter of Water, half a Quarter of Wine, half a Quarter of  
L of

of good Vinegar, four Ounces of Vitriol, four Ounces of Gall, both powder'd by itself; then mix it together in a glazed Vessel, and pour the foresaid Matter upon it, stir it often, during six or more Days, and when settled, pour it into a Bottle, and you will have very good Ink.

*To prepare Red Ink.*

**T**AKE two Ounces of fine Brasil Chips; the White of 12 Eggs, and the Quantity of a Hazel Nut of Alum; beat the White of the Eggs clear; put it all together in the Sun, or before the Fire; stir it sometimes about; strain it through a Cloath, and let the Juice dry well; then keep it from Dust, and when you will use it, only temper it with fair Water,

*Or,*

**T**AKE the best Fernambuck, put it into a Cup or Pot that's glaz'd, pour good Wine Vinegar over it, let it stand three or four Hours to soak, then take Beer that's clear and bright, mix it with clear Pump Water, about an Inch above the Chips; set it on a middling Fire, let it boil, and take Care it does not run over; after it has boiled some Time, add Alum, the Quantity of a Wallnut, powder'd, to it, and as much Gum Arabick, set it again upon the Fire, and let it boil; after it has boil'd a little, take it off, and strain the Liquor from the Chips; put it into a Glass, close it up, and you will have a fine red Ink.

It instead of Alum you put a little Sal Armoniac to it, it will make the Ink look bright.

*Yellow Ink.*

**T**AKE the Leaves of yellow Cowslip Flowers, that grow common in the Fields, squeeze out the Juice, and mix it with Allum.

*Or,*

**M**IX a little Alum to some Saffron and Water, which makes a very good yellow Ink.

*To Write Letters or any Thing else either with Gold or Silver.*

**T**AKE Flint-Glass, or Crystal, grind it to Powder, temper it with the White of an Egg; Write with it, and when it is dry, take a Gold Ring, or a Silver Thimble, or any Thing of either of those Metals, rub your Writing therewith gently over, and when you see the Gold or Silver strong enough, glaze it over with a Tooth.

*To Write with Gold out of a Pen.*

**T**AKE 16 Leaves of the finest Gold, put it upon a Colour-Stone, sprinkle a little Vinegar over it, and let it lay for a little while, then grind it with your Muller to a fine Powder, put this into a Muscle Shell, with as much clear Water as will fill it, mix it together with your Finger, then let it settle, and after that pour off the Water, and supply it with clear Water again, stir it well with your Finger, as before; this repeat so long till you see the Water comes off from the Gold as clear as when put on; after you have thus clear'd your Gold, temper as much as you have occasion for present use, with a little clear Gum Water, till you see it will easily flow from your Pen; after your Writing is dry, glaze it gently with a Tooth.

*Fine Red Ink, of Vermillion.*

**T**AKE Vermillion, grind it fine with clear Water, and put it up to keep it from Dust; when you use it, take as much as you think you shall have occasion for, and dilute it with a little Gum-Water.

*Another.*

**T**AKE half an Ounce of Vermillion, or prepared Zin-  
naber, put it into a Galley Pot, take a little powdered clear Gum Arabick, dissolve it in Water and temper therewith your Vermillion; you may add a little of the White of an Egg to it, which you beat up till all becomes a Scum, and when you let it stand, the Settling will be like clear Water, which is fit for Use.



*An Artificial Water for writing Letters of Secrecy.*

**T**AKE Vitriol, finely powder'd, put a little thereof into a new Ink Horn, pour clean Water on it, and after it has stood a little, write therewith either on Vellum or Paper, and the Writing cannot be teen any other Way, than by drawing the Letter through a Water, which is thus prepar'd: Take a Pint of Water, put into it one Ounce of Powder'd Gall, temper it together, and strain it through a Cloth, put the Water into a Dish that's wide enough, and draw your Writing through it, and you will read it as plain as you do other Writings; and to make the secret Contents less liable to Suspicion, you may write on the contrary Side of the Paper or Parchment with black Writing Ink, Matters of less Consequence.

*Another Secret, to write a Letter white upon white, which cannot be read but in fair Water.*

**T**AKE clean Alum, beat it to a fine Powder, mix it with Water, but not too thin; then take a new Pen, and with this Mixture write what you please upon Paper, and let it dry: Then let him, who is to read it, lay the Letter into a flat Bason or Dish, that's fill'd with clean Water, and in a Quarter of an Hour the Letters will appear white upon white, so that they may be plainly seen and read.

*Another.*

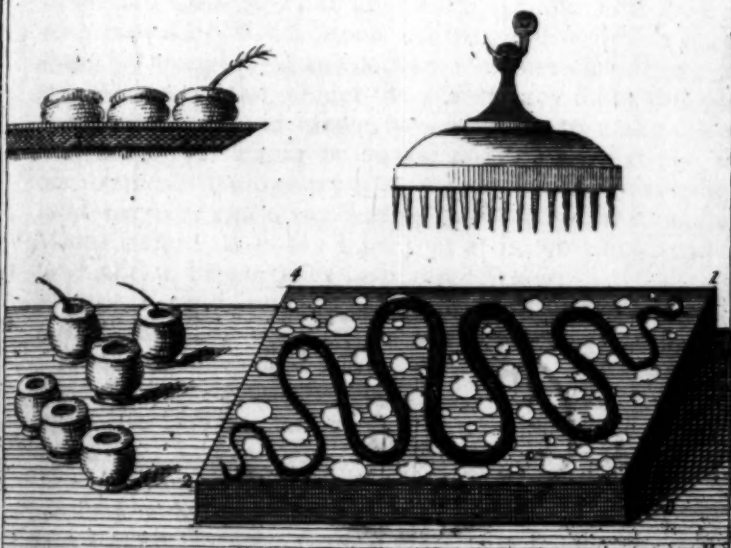
**T**AKE the Juice of Onions, write with it, he who will read it, must hold it over the Fire, and the Writing will turn of a reddish or brownish Colour.

*The Manner of marbling Paper or Books.*

**T**AKE clear white Gum Tragant, put it into an Earthen Pan, pour fresh Water to it, till it is two Hands high over the Gum, cover it and let it soak 24 Hours, then stir it well together; add more Water to it; keep it often stirring for a whole Day, and it will swell; keep it standing several Days, according as you find your Gum is fresh or stale; for the fresh will dissolve sooner than that

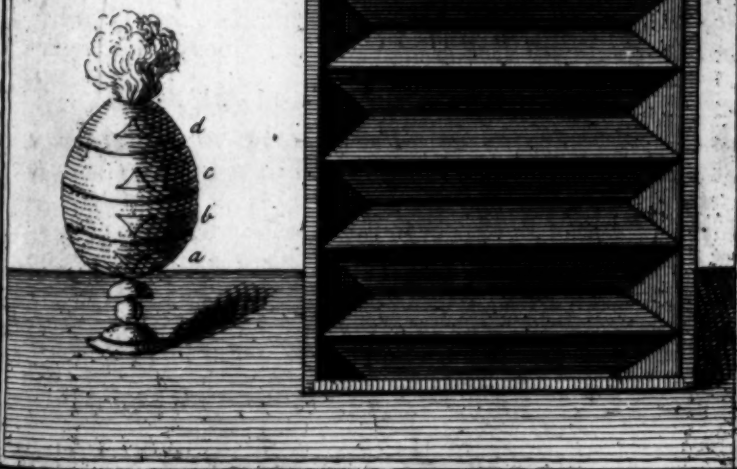


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that which has laid by a long time. Keep it now and then stirring; when you find it well dissolved, pour it through a Collender into another Pan; add to it more Water; and after it has stood a little, and been stirr'd about, strain it through a clean Cloth into another clean Pan; keep it well covered, to hinder the Dust or any other thing from coming to it: This Water, when you go to make use of in Marbling your Paper or Books, must be neither too thick nor too thin; you may try it with your Comb, by drawing the same from one end of the Trough to the other; if it swells the Water before it, it is a Sign that it is too thick, and you must add in Proportion a little more Water.

Your Trough must be of the largeness of your Paper, or rather something wider, and about four Inches deep.

After you have fill'd your Trough with the foremention'd Water, and fitted every thing for the Work, then (before you lay on your Colours) take a clean Sheet, and draw the Surface, which will be a thin sort of a Film, off on't; then have your three Colours, namely, Indigo mixt with White Lead, yellow Oaker, and Rose Pink, ready prepared at Hand, and for each Colour have two Galley-Pots, in order to temper them as you would have them in different Shades.

All your Colours must be ground very fine with Brandy:

The Blue is easily made deeper or lighter, by adding more or less White Lead.

The Yellow used for that Purpose, is either yellow Orpiment or *Dutch Pink*;

For Blue, grind Indigo, and White Lead, each by itself, in order to mix that Colour either lighter or darker.

For Green, take the foresaid Blue and White, add some yellow to it, and temper it darker or lighter, as you would have it.

For Red, take either Lake, or Rose Pink.

Every one of these Colours are, as we said before, first ground very fine with Brandy, and when you are ready to go to Work, add a little Ox or Fish-Gall to them; but this must be done with discretion, and you may try them by sprinkling a few drops upon your Gum Water; if you find the Colour fly and spread too much about, it is a Sign of too much Gall, which to remedy, add more of the same Colour which has none, but when you see the Colour spread and detract it self again gently, it is right.



When thus you have your Colours and all Things in good order, then take a Pencil, or the end of a Feather, and sprinkle or put first your red Colour; then the Blue, Yellow, Green, &c. begin your red from N° 1, and go along your Trough to N° 2; also the Blue from N° 3, all along to N° 4. The yellow and green you put here and there in the vacant Places; then with a Bodkin or a small Skewer, draw a Sort of a Serpent Figure through the Colours, beginning from N° 1, to N° 2: When this is done then take your Comb and draw the same strait along from N° 1, to N° 2. If you will have some Turnings or Snail Work on your Paper, then with a Bodkin give the Colours what Turns you please.

Thus far you are ready in order to lay on your Paper, which must have been moisten'd the Day before, in the Nature as the Book Printers do their Paper for Printing; take a Sheet at a time, lay it gently upon your Colours in the Trough, press it slightly with your Finger down in such Places where you find the Paper lays hollow; this done, take hold at one end of the Paper, and draw it up at the other end of the Trough, hang it up to dry on a Cord, when dry, you glaze it, and it is done. You may if you will embellish your Paper with Streaks of Gold, by applying Musc Gold or Silver tempered with Gum-Water, among the rest of the Colours.

*To prepare Ink, so that what is wrote therewith cannot be read but in a dark Place.*

**T**AKE half a pint of Goat's Milk, a sweet Apple, peeled and cut, a handful of Touch-Wood, which in the Night time appears to be lighted; put this and the Apple into a Mortar, beat them together, pouring now and then a little of the Goat's Milk to it; after it is well beaten, pour the rest of the Milk to it, stir it well together, then wring it through a Cloath, with this Liquor write what you please, and if you will read it, go into a dark Cellar or Chamber, and the Writing will appear of a fiery or Gold Colour.

*To make fine red Paper.*

**T**AKE a Pan full of Water, put some Quick Lime into it, to make it into a Lec, and let it stand over Night,

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Night; then put Brasil Chips into a clean Pot, about half full, fill it with the Lees, and boil it to half; and when it is just hot, add to it a little Alum: When you go to use it, mix it with a little Gum or Size, and then with a pretty large Pencil lay your Colour on the Paper with an even Hand.

*To prepare Ink for drawing of Lines, which when writ upon, may be rubb'd out again.*

**B**URN Tartar to Ashes, or till it is calcined to a white Colour; take thereof the bigness of a Hazle Nut, and lay it into a Cup full of Water to dissolve, then filtrate it: To this Solution mix as much fine grounded Touch Stone as will colour it black enough to write with: With this Ink you rule the Lines to write upon; when you have done writing, you only rub it over with the Crumb of a stale Roul, or with Crumbs of Bread; the Lines will vanish and the Paper be as clean as it was before. This may be made useful for Schools.

*To Write so that the Letters appear White, and the Ground of the Parchment Black.*

**T**AKE clean Water, temper it with the White of Eggs so as to write therewith; with this write upon your Vellum or Parchment what you please, let it dry and draw it through Ink, so that it may take every where; or strike it over with a Pencil to make it of a good black; when it is thorough dry, then scrape it gently off with a Knife, and draw it carefully through fair Water, let it dry, and your Writing will appear as white as the Parchment was, before you wrote upon it.

*To make Oil Paper.*

**T**AKE the Shreds of Parchment, boil them in clean Water, so long till the Water is clammy and like a strong Glue, pour it through a Cloath, and with a large Pencil strike it over the Paper; when dry, varnish it over with a Varnish of Turpentine, or the *Spanish* Varnish mentioned in the First Article under this Head.



## V.

Choice Secrets for CABINET-MAKERS and  
TURNERS.

*To prepare a black Colour for staining Wood.*

**P**UT two Ounces of Iron-Filings into a new earthen Pan; add to it one Ounce of Sal-armoniac, dissolv'd in a Quart of Vinegar, and let it stand 12 Days, the longer it stands the better it will be; then take rasp'd Logwood, and three Ounces of Gallnuts, pounded fine; infuse this in a Quart of Lee made of Lime, let this also stand the same time as the above.

When you have occasion to use it, warm both those Liquids over a slow Fire, and with the Lee first strike the Wood over you design to dye, and then with Vinegar; repeat this till you see the Wood black enough to your likeing; after which, wax the Wood over with Bees-Wax, and rub it with a woolen Rag, and it will look bright and fine.

*To imitate Ebony-Wood.*

**T**AKE clean and smooth Box, boil it in Oil till it turns black, Or,

Take smooth plain'd Pear-Tree Wood, strike it over with Aqua Fortis, and let it dry at a shady Place, in the Air; then wipe it over with good black Writing Ink, let it also dry in the Shade; repeat and wipe the Ink over it, so long till the Black is to your likeing. Then polish it with Wax, and a Cloath Rag.

*Another, but more costly Method.*

**D**ISSOLVE one Ounce of fine Silver to one Pound of Aqua Fortis; add a Quarter of a Pint of clear Water to it, with this strike your Wood over; repeat it so long till you perceive it to be as black as Velvet, then polish it with Wax.

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*Another Way to imitate Ebony.*

**T**AKE what Sort of Wood you will, as Box, Cedar, Mulberry, Pear-Tree, and the like; steep it for three Days in Allum-Water, in a warm Place, or if in Summer, by the Sun; then boil it to Oil, in which mix some Vitriol and Sulpher; the longer you boil it, the blacker will be the Wood; however you must not let it boil too long, lest it should be scorch'd.

*Another.*

**S**TRIKE your Wood over with Spirit of Vitriol, hold it over a Coal Fire, and repeat this till it is black enough; then polish it.

*Another.*

**I**RON Filings steeped in Beer and Urin, makes a good Black.

*Another.*

**P**UT one Pound of rasp'd Brasil in a clean Pan, boil it in three Pints of strong White-Wine Vinegar, till the half is boil'd away, then pour it clear off: Take also one Pound of bruised Gallnuts, put them into another Pan with Water, and let them stand for eight Days in the Sun to soak; then put to it eight Ounces of Vitriol, stir it together, and let it stand for two or three Days; pour it off clear, and add to this Liquid the fourth Part of the prepared Brasil, and with this strike your Wood over 20 or 30 Times running, letting it every Time dry in the Shade.

Then take fine Silver, as much as you please, dissolve it in common Aqua Fortis, add to it twice the Quantity of Spring-Water; with this strike over the dy'd Wood once or twice, set it in the Air to dry, and it will be of a fine Coal Black; after which polish it as before directed.

*To dye Wood of a Red Colour.*

**T**AKE one Handful of Quick-Lime; two Handfuls of Ashes, put it together into Rain Water, and let it soak  
for



for half an Hour, till it is well settled, and you have a good Lee. Then take a new Pan, in which put one Pound of Fer-nambuck, pour on it the said Lee, and after it is soak'd for half an Hour, let it boil, and when it is cool, pour it off into another clean Pan, and fling one Ounce of Gum-Arabick into it; take another earthen Pan with Rain-Water, put into it two Ounces of Alum, boil your Wood in it, and after it is well soak'd, take it out, let it cool a little, warming the mean while the red Colour, and striking it over your Wood; repeat this till your Colour is deep enough to your liking; then polish it with a Dog's Tooth.

*Another Red, for Dying of Wood.*

**T**AKE rasp'd Brasil, boil it till you see it of a fine red Colour, then strain it through a Linnen Cloath.

The Wood you design to dye, you colour first over with Saffron Yellow, and after it is dry, you strike it over with the red Colour, so long till it is deep enough; then polish it with a Tooth. If you put a little Allum to the Brasil-Colour, it will turn it to a Brownish Hue.

*To marble upon Wood.*

**T**AKE the Whites of Eggs, beat them up till you can write or draw therewith; then with a Pencil or Feather draw what Veins you please upon the Wood; after it has dry'd and harden'd for about two Hours, then take Quick-Lime, mix it well together with Wine, and with a Brush or Pencil paint the Wood all over; after it is thorough dry, you rub it with a scrubbing Brush clear off, so that both the Lime and the Whites of the Eggs may come off together; then you rub it with a Linnen Rag till it is smooth and fine; after which you may lay over a thin Varnish, and you will have a fine marbled Wood.

*Another.*

**G**RIND White Lead or Chalk together with Water upon a Marble very fine, then mix it up with the Whites of Eggs well beaten, wherewith you may paint or marble as you think proper; when dry, you strike it over with a Lee made of Lime and Urin, this will give the Wood a brown-red Colour;

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Colour; upon this Colour you may, when dry, marble again with the Whites of Eggs, and again when dry, give it another Brush with the Lee; after you have with a scrubbing Brush rub'd off the Marbling Whites of Eggs, then you may strike it once more all over with the Lee, and your Work when dry and polish'd, will look very pleasant and of a fine Marbling.

*A Gold, Silver, or Copper Colour on Wood.*

**T**AKE Crystal, beat it in a Mortar to Powder, then grind it on a Marble with clean Water, and put it into a clean new Pot, warm it, and add to it a little Glue, with this strike or paint over your Wood: When dry, take a Piece of Gold, Silver or Copper, and rubbing it over therewith, you will have the Colour of any one of those Metals upon the Wood, which you afterwards polish.

*To colour Wood of a Walnut Tree Colour.*

**T**AKE the Bark of Walnut Trees, or the Green Shells of Walnuts, dry them in the Sun, mix, as much as you have occasion for, with Nut-Oil, boil it up, and rub the Wood over therewith.

*To stain Wood a fine Green.*

**T**AKE green Nut-Shells, put them into a Lee made of Roman Vitriol and Alum, in which let them boil an Hour or two. To this Lee add some Verdegrease, finely ground with Vinegar, then take your Wood, after you have soak'd it for two Days in strong white Wine Vinegar, and boil it therein.

*Another.*

**T**AKE the finest Verdegrease, grind it with sharp Wine Vinegar, add to it a little Tartar; let it stand over Night, the Verdegrease will settle, and you will have a fine Green; with this strike over your Wood for several Times: If you will have it Grass-Green, then put a little Sap-Green among it.

*A Red Colour for Wood.*

**T**AKE Quick-Lime, pour Rain-Water upon it; let it stand over Night, and filter it through a Cloath; then add more Rain-

Rain-Water to it, and put clear and fresh Brasil-Chips in, together with the Wood you intend to dye, and boil it so long till the Colour is to your Mind. The Wood is first to be thoroughly soaked in Alum-Water.

*Another Method.*

**P**OLISH your Wood-Work, after you have finish'd it with your Plain, and then lay on it Muscled-Gold or Silver, deluted with Size or with the White of an Egg; marbling it in the Manner above directed in marbling of Wood, and when dry, you strike it over for several Times with the following Colour:

Take fine rasp'd Brasil, pour on it, or infuse it in Oil of Tartar, and it will extract a fine red Colour: This colour'd Oil you pour off, and put fresh to the Brasil, to extract more Colour. These Extractions you let gently dry, then draw it off again with Spirit of Wine, and you will have a fine Red for your Use.

*A Violet Colour for Wood.*

**T**AKE four Ounces of Brasil, and one Ounce of Indigo, infuse it together in a Quart of Water, and boil your Wood therein.

*To adorn Wood with Ornaments of Silver or Tin.*

**F**IRST you carve or hollow your Ornaments out upon your Wood in the best Manner, so as to undermine the Edges on both Sides of your Strokes. Then make an Amalgama of Tin, by dissolving it over a gentle Heat, and putting into it the same Quantity of Quicksilver, which, before you have heated, stir with a Stick well together, and pour it into a Pan of cold Water; when dry, you grind it upon a Marble with Water very fine, tempering it with clear Size; and fill up the carv'd Figures, smoothing it with your Hand, and when dry polish it. To make it more of a Silver Colour, rub it over with an Amalgama of Silver and Quick-silver, and polish it with a Dog's Tooth.

Instead of Tin, you may also use Bismuth grounded fine with Water.

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*To Emboss or Trace all Manner of Ornaments on a gilded smooth Pannel, the Gold being laid over with Black or any other Colour.*

**F**IRST gild your Pannel or other Wood Work, as you are directed under the Article of Gilding, and when thorough dry, paint it all over smooth and even with Lampblack, ground with Linseed and Nut-Oil; add to it an equal Quantity of Umber, in order to dry it the better; after you have set it for two or three Days, or according to the Conveniency or the Time of the Year, to dry, then, before it is quite hard, draw or pounce what you design to emboss upon, and with a blunt pointed Bodkin, Horn, or Wood, you trace into the black Lay, down to the Gold, opening those Places, and making the Gold appear in the best Manner you can. In Birds, Plants, Cattle, and such like, you must observe to take the Heightenings out clear, and leave the Shade, by Hatching into the Black, agreeable to your Design; the fine and soft Shades of the Hair, &c. you may finish with a fine Pencil, with the black Colour, upon the Gold; and when you have done, let it thoroughly dry for three or four Days more; then lay over it a clear Varnish, which you may, after it is dry'd, repeat a second Time, and your Work will look beautiful.

*To do this upon a blue Ground.*

**A**FTER you have gilded your Work, then take Alum which is not too coarse, mix it with Water on a Marble Stone, adding to it the White of an Egg; with this and a little Water mix your Smalt, and strike it fine and even over the Gilding: Then, when it is almost dry, sift through a fine Sieve some of the finest Smalt over it: You may, if you will, mix it with Spangles of several Colours; and when thorough dry, wipe off what sticks not to it, and proceed in tracing up your Figures you design for Gold. The fine finishing Strokes upon the Gold because they cannot well be done with Smalt, you may use *Prussian Blue* or *Indigo* mix'd with *White Lead*. You may, if you will, varnish it, but it will look better without.



Vari-





Varieties of GLUES and CEMENTS, for joining not only *Wood*, but also *Stone*, *Glass*, and even *Metals*.

*An excellent Glue for Wood, Stone, Glass, and Metal.*

**T**AKE good Glue four Ounces, soak it over Night in distill'd Vinegar, then boil it up with Vinegar; take a Clove of Garlick, beat or bray it in a Mortar, add to it one Ounce of Ox-Gall. This Juice wring through a Linnen Cloath into the warm Glue; then take Mastic and Sarcocollæ, of each one Dram, Sandarac and Turpentine of each two Drams; grind the Sandarac and Mastic fine, and put it together with the Sarcocollæ and Turpentine into a little Phial; pour one Ounce of the strongest Brandy upon it, and let it stand three Hours in a moderate Heat, well stopp'd up, giving it now and then a Shake, put this also to the warm Glue; then stir or beat it together with a wooden Spatula, till some of the Moisture is evaporated, and the Glue is grown cold. When you have occasion to use it, then take as much or little as your Work requires, soak it in strong Vinegar, till it is dissolv'd. If you use this Glue for Stones, you mix it with Tripoli, or with some powdered Chalk; and if for Glass, you mix, besides a little Tripoli, fine ground Venice Glass; and if you will use it for Metals, as Iron, Brass, Copper, you put to it some of the finest Filings; you may also add a little Isinglass. And if you will have this Glue hold out or stand the Water, you mix it up with a strong Varnish as much as present Occasion requires.

*A good Stone Glue or Cement for Grotto Work.*

**T**AKE two Parts of white Rosin, melt it clear, add to it four Parts of Bees-Wax; when it is melted together, add Stone-Flower of the Stone you design to cement, two or three Parts, or so much as will give the Cement the Colour of the Stone; to this add one Part of Flower of Sulpher,

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**C**OMM Varn after they and stand

**T**A K in f and mix w very strong

**T**A K and put in it pour it o Vessel, di Dust; and

**T**A K of Eggs.

*Stone-Glue*

**T**A K fin an Iron c like a th glew tog Stone or

pher: first incorporate all together over a gentle Fire, and afterwards knead it with your Hands in warm Water. With this you cement the Stones, after they are well dry'd and been warm'd before a Fire, in order for to receive the Cement the better.

*A Wood Glue, which stands the Water.*

**C**OMMON Glue mix'd up with Linseed Oil or Varnish, applied to the Places to be glued together, after they have been warm'd, when thorough dry, it will last and stand the Water.

*Another fine Glue.*

**T**AKE Isinglass and common Glue, soak it over Night in strong Brandy; then dissolve it over a Coal Fire, and mix with it a little fine powder'd Chalk; it will make a very strong Glue.

*Another extraordinary Glue.*

**T**AKE Sal Armoniac, Sandarac and Gum-Lacca, soak and dissolve it in strong Brandy, over a gentle Heat, put in it a little Turpentine; when all is dissolv'd, then pour it over Isinglass and common Glue, and in a closed up Vessel, dissolve it over a slow Fire; add to it a little Glass-Dust; and when it is of a right Temperament, use it.

*A good Water-Cement.*

**T**AKE one Part Menin or Red Lead, and two Parts of Lime; mix it well together with the Whites of Eggs.

*Stone-Glue, wherewith you may glue either Stone or Glass.*

**T**AKE white Flintstone Powder, which is dry and finely searched; then take white Rosin, melt it in an Iron or earthen Panniken, stir the Powder in it, till it is like a thick Paste; warm the Glass, or what you design to glew together, strike it over, and after you have laid your Stone or Glass together, gild the Places or Joinings, and it will

will add a great Beauty. This has been made use off in the Embellishment of Cabinets, and other Things.

*A Cement for broken Glasses.*

**B**EAT the white of an Egg very clear, mix with it fine powdered Quick Lime, with this join your broken Glasses, China and earthen Ware,

*Or,*

**T**AKE old Varnish, glue therewith your Pieces together, tie it close, and let it to dry at the Sun, or a warm Place; when dry, scrape off the Varnish that's press'd out at the Sides, and it will hold very well.

*To join broken Amber.*

**A**NOINT the Pieces with Linseed Oil, join and hold them close together over the Fire.

*An excellent Glue or Cement to mix with Stone, Glass, Marble, &c. in order to make Utensils, Images and other Things therewith.*

**T**AKE Fish Glue well purified, four Ounces; Mastick two Ounces, powdered Sealing Wax six Ounces, fine ground Brick dust one Ounce; put the Fish Glue into a glaz'd Pipkin upon a slow Fire; and after you have mix'd your Ingredients, put it together into the Pipkin, boil it up, and what hangs together use: If you mix it up with fine powdered Glass, of any Colour, you may form it to what Shape you will, and when cold and dry, it will be as hard as a Stone.

*Another Cement which dries quickly.*

**T**AKE Pitch, as much as you will, melt it, and mix it with Brick Dust and Litharge, and to make it harder, moisten the Brick-Dust first with sharp Vinegar, and take a larger Quantity of the Litharge, it will be as hard as Stone.

*Good*

*Good Glue Sticks, or Spittle Glue, fit for Bookbinders.*

**T**AKE two Ounces of Isinglass, half an Ounce of Sugar-Candy, and half a Dram of Gum Dragant. Then take half an Ounce of slips or shags of white Parchment, pour on it a Pint of Water, and let it boil well; take that Water, strain it through a Cloath, and pour it over the two other Ingredients, mix'd with a little Rose Water; let it boil away above half, then take it off the Fire, and cast it into little flat Sticks, or in any Shape you please.

*A Water Cement, which, the longer it is in Water, the harder it grows.*

**T**AKE Mastick, Incense, Rosin, and fine cut Cotton, of each an equal Quantity, melt, and with some powder'd Quick Lime; mix it up into a Mass.

*A Cement as hard as Iron.*

**M**ELT Pitch, then rake ground Sand, which comes off the Smiths or other grind Stones, stir it well together, boil it up, and it is fit for Use.



Several curious Secrets relating to IVORY, BONE, and HORN.

*To whiten Ivory that's turn'd to a reddish or yellow Colour.*

**P**UT Alum into fair Water, so much as to colour it pretty white, then boil it up; in this put your Ivory for an Hour to soak; rub it with an Hair Cloath, and wipe it over with a clean Napkin or Linnen Rag, which is moisten'd before; in this let it lie, till it is dry of itself, else it would be apt to split.

M

*Another*



*Another Method to whiten Green Ivory.*

**B**OIL the Ivory in Water and Quick-Lime, so long till you see it has a good White.

*To marble upon Ivory.*

**M**ELT Bees-Wax and Tallow together, or else yellow and white Bees-Wax, and lay it over your Ivory; then with an Ivory-Bodkin, you open the Strokes that are to imitate Marbling, pour the Solution of some Metal or other on them, and let it stand a little while; then pour it off, and when it is dry, cover those Strokes again with Wax, and open some other Veins with your Bodkin for another metallick Solution; and this you repeat to the Number of Colours you design to give it.

The Solution of Gold gives it a Purple; of Copper, a Green; of Silver, a Lead Black; of Iron, a Yellow and Brown Colour. These Solutions well manag'd, and apply'd on Ivory, will intirely answer the Satisfaction of the Artist.

By this Method you may imitate Tortoise-Shell, and several other Things on Ivory.

*To stain Ivory of a fine Green.*

**T**AKE to two Parts of Verdegrease one third of Sal Armoniac; grind it well together, pour strong white Wine Vinegar on it, and put your Ivory into it; let it lie covered, till the Colour is penetrated, and deep enough to your likeing. If you will have it marbled or spotted, sprinkle or marble it with Wax.

And thus you may colour your Ivory with any other Colours, if you prepare them in the Manner directed, *vis.* With Sal Armoniac and Vinegar.

*To dye Ivory or Bone of a fine Coral Red.*

**M**AKE a Lee of Wood-Ashes, of which take two Quarts, pour it upon one Pound of Brasil, in a Pan; to this add one Pound of Alum, two Pound of Copper Filings, and boil it for half an Hour; then take it off, and let  
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it stand: In this put the Ivory or Bone, the longer it continues in this Liquor, the redder it will be.

*To stain Ivory or Bone of a Black Colour.*

**T**AKE Litharge and Quick-Lime, of one as much as the other, warm it in Rain-Water, till it begins to boil. In this put the Bones or Ivory, stirring them well about with a Stick; and afterwards when you see the Bones colour, take the Pan from the Fire, stirring all the while the Bones, till the Liquor is cold.

*To make Horn soft.*

**T**AKE Man's Urin, which has been put by and cover'd for a Month; in this boil one Pound of Weed-Ashes, or the Ashes of Wine-Stalks, two Pound of Quick-Lime, eight Ounces of Tartar, and eight Ounces of Salt; after it is boil'd, pour it through a Cloath, and filter it thus three times running: Keep this Lee covered, and soak the Horn therein for eight Days, and it will be soft.

*Another.*

**T**AKE Weed-Ashes and Quick-Lime; of this make a strong Lee, filter it clear, and boil the Shavings or Chips of Horn therein, and they will be like a Paste: You may colour it of what Colour you please, and cast or form it in any Thing you intend.

*To prepare Horn Leaves in Imitation of Tortoise-Shell.*

**T**AKE Quick-Lime one Pound, and Litharge of Silver eight Ounces; mix it with some Urin into a Paste, and make Spots with it, in what Form or Shape you please, on both Sides of the Horn; when dry, rub off the Powder, and repeat this as many times you will. Then take Vermillion, which is prepared with Size, lay it all over the Horn, as also on the Wood, to which you design to fasten it.

For Raised Work, you form the Horn in a Mould of what Shape soever; put it by to dry, and with the aforesaid Paste and the Vermillion give it the Colour; then lay on a clear Glue (neither too thick, nor too thin) upon both the Horn

and the Wood on which it is to be fixed, and close it together; do this Work in a warm Place; and let it stand over Night, then cut or file off the Shag, or what is superfluous about; rub it over with a Coal, and polish it with Tripoli and Linseed Oil.

The Work made in this Manner looks very beautiful and natural, and may be used by Cabinet-Makers for Pillars, Pilasters, Pannels, or any other Embellishment in Cabinet-Work.

*Another Method to Counterfeit Tortoise-Shell on Horn.*

**T**AKE good Aqua-Fortis two Ounces, fine Silver one Dram; let the Silver dissolve, and after you have spotted or marbled your Horn with Wax, strike the Solution over it; let it dry of itself, and the Horn will be in those Places, which are free from Wax, of a brown and black Colour. *Or,*

Lay the Wax all over the Horn, then with a pointed Skewer or Iron draw what you will, laying the Figure you draw open on the Horn; then pouring on the above Solution; let it stand a little, and after you have pour'd it off, either scrape or melt the Wax, wipe it with a clean Rag, and polish it.

Instead of the Silver Solution, you may boil Litharge of Silver in a strong Lee made of Quick-Lime, so long till it tinctures black: *Or,* instead of Silver you may dissolve Lead in Aqua-Fortis.

*To solder Horn together, after it has been lin'd with proper Foyles or Colours.*

**T**AKE two Pieces of Horn, made on Purpose to correspond together, either for Handles of Knives, Razors, or any thing else; lay Foyles of what Colour you please on the Inside of one of the Horns, or instead of Foyles painted or gilded Paper or Parchment; then fix the other Piece upon it; lay a wet Linnen Fillet, twice doubled, over the Side Openings, and with a hot Iron rub it over, and it will close and join together as firm as if made out of one Piece.

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*To dye Horn of a Green Colour*

**T**AKE two Parts of Verdegrease, one third Part of Sal Armoniac, grind it well together, pour on it strong white Wine Vinegar, and it will be tinged of a pleasant Green; then put your Horn into it, let it lay therein till you see it dy'd to what Height you wou would have it.

*Another Method.*

**T**AKE the Green Shells of Walnuts, put them into a strong Lee, with a little Vitriol and Alum, let it boil for two Hours, and lay the Horn for two Days in strong Vinegar; then put half an Ounce of Verdegrease, ground with Vinegar, into the Lee, boil the Horn in it, and it will be of a fine Green.

*To die Horn of a Red Colour.*

**T**AKE Quick Lime, pour Rain Water upon it, and let it stand; filter it through a Cloath, and put to it one Quart of clean Water, and two Ounces of ground Brasil; lay the Horn into it, then boil it, and you will have a fine Red, if before you have soak'd it for a While in Alum Water.

*To stain Horn of a Brown Colour.*

**T**AKE Quick-Lime, slacken it with Urin, and strike it over the Horn; then take Red Curriers Water, wash the Horn therein, and it will turn to a Green Colour; wipe it over again with the said Lime, and when dry, wash it with Lee; let it lay therein a whole Day, it will be of a fine Chestnut Colour.

*To dye Horn of a Blue Colour.*

**T**AKE a Brass Bowl, and when you have made it red hot, wipe it over with Sal Armoniac; then pour Lime-Water upon it, stir it together, and you will have a Blue Water, in which lay your Horn; the longer you let it lay, the deeper will be the Colour.





## VI.

## OF VARNISHING OR JAPANING ON WOOD, &amp;c.

*A white Varnish.*

**T**AKE ten Ounces of rectified Brandy, and fine pulverised Gum Sandarac two Ounces, clear Venice Turpentine two Ounces, put it together into a Glass, and cover it close with wax'd Paper and a Bladder; then take a Pot with Water, put it on a Coal Fire, and when it begins to be warm, put some Hay on the Bottom of the Pot, on which set your Glass; then let it Boil for two or three Hours, and the Sandarac and Turpentine will dissolve, and unite with the Brandy: Then pour your Varnish boiling hot through a clean Hair Cloath, and put it up in a clean Phial for Use. This is an excellent Varnish, fit to be used for Varnishing light Colours, as White, Yellow, Green, Sky, Red, also such Things which are silver'd or gilded.

*Another Varnish fit to mix with red or dark Colours, and to Japan the Work over therewith.*

**T**AKE rectified Brandy which will stand Proof; that is, when pouring some of it on Gun-Powder, it will light it; or, when a Linnen Rag being dipt into it, and lighted, it will consume it, one Pound; of clean Gum Lacca, a quarter of a Pound; grind it fine, and put it into a Phial; then pour the Brandy over it, let it stand for two Days (swinging and shaking it about once every Hour) the third Day hang it over a gentle Heat of Coals till it is well dissolv'd, then strain it through a Hair Bag and put it up for Use.

*Another Lac Varnish.*

**T**AKE of the best and strongest Brandy one Quart, calcined Tartar one Pound, let the Brandy stand upon the  
Tartar

Tartar, close covered, for one Day, in a gentle Warmth; then pour off the Brandy and filtrate it through a Paper; of this take one Pound, white Amber six Ounces, Sandarac six Ounces, Gum Lacca two Ounces (the Amber must not be of the Drofs, or Powder, but pick'd out of clear Pieces) grind all fine together, put it into a Phial or Matrafs, then pour on it three Pound of the filtrated Brandy: your Phial must be but about half fill'd; then swing and shake it about for an Hour together, keep it in the Matrafs for two Days, giving it a Shake about once every Hour; when settled, pour it through a Hair Cloath, and it is fit for Use.

What Settling there remains in the Phial, may be used in making another such Quantity of Varnish, adding to it but half the Quantity of fresh Ingredients.

*Another Lac Varnish.*

**T**AKE high rectified Brandy one Pint, Gum Lacca four Ounces, Sandarac two Ounces, white Amber one Ounce, white Frankincense one Ounce; Powder these in a Stone Mortar very fine, and put it together, with the Brandy, into a Phial or Matrafs, stopping it very close; set it in the Heat of the Sun, or in Winter Time in a warm Place, and after it has stood three or four Days, set it on Ashes over a Charcoal Fire, boil it softly for two Hours, and when you see the Brandy of a yellow-brownish Colour, and of a thickish Consistence, pour it hot through a Hair Cloth, and preserve it in a clean Phial for use.

*A White or clear Lac Varnish.*

**T**AKE Gum Elemi, Gum Animæ, white Frankincense, and white Amber, of each one Dram, grind it fine, put it into a Glass, and boil it in distill'd Vinegar; then pour off the Vinegar, and wash the Settlement with clean warm Water, and it will be of a white Colour; dry it, and grind it fine again; add to it one Dram of Gum Dragant, two Drams of white Sugar-Candy, both finely ground, put it by little and little into a Matrafs, wherein you have before hand put two Pound of high rectified Brandy; and after you have put all the Ingredients into it, shake it about for an Hour together; then put it into a *Balneum Marie*,

and when it begins to boil, keep it so for two Hours; then let it cool; and after you have let it stand for three Days, pour it off into a clean Phial, stop it close, and save it for Use.

*Another Method.*

**T**AKE the above specified Ingredients, boil them in Vinegar as directed, and after you have put to it the Gum Dragant and Sugar-Candy, take of clear Oil of Spike or Turpentine one Pound, Cyprian Turpentine six Ounces, put it together into a strong Matrafs, and set it, provided with a Leaden Ring, in a Balneum; when the Balneum begins to boil, and the Turpentine is dissolv'd and becomes pretty warm, then add the other fine ground Ingredients to it, stir them with a Wooden Spatula well together, and let it stand in the boiling Balneum for three or four Hours; then take it out, and when cold, and has stood two or three Days, pour it into a clean Phial, and you will have a fine Varnish.

*A fine Varnish for Blue and other Colours, which will make them bright like a Looking Glass.*

**I**F your Table is to be of a blue Colour, then paint it first over with Indigo and White, ground with Oil, and a little Turpentine; when dry, you may give it another Lay and heighten and deepening it to your likeing, and when this is thorough dry, then varnish it with the following Varnish:

Take clear Cyprian Turpentine half an Ounce, Sandarac one Ounce, Mastic two Ounces; grind the Sandarac and Mastic very fine; then take Oil of Spike two Ounces, Oil of Turpentine one Ounce, put it into a Glass, and dissolve it over a gentle Heat; add to it the pulverised Gum, set the Glass or Matrafs in a Pan with Water, and let it boil over a slow Fire for an Hour, and all will be dissolv'd and united; then let it cool, preserve it in a Phial well clos'd up for Use.

When you use it, first wipe your painted Table, and clean it from all Dust, then take some fine and light Smalt in a Cup, or upon a Plate, according to what Quantity your Piece requires, temper it with the above Varnish, and with a large Hair brush Pencil glaze it quick all over; let it dry in a clean Place that's free from Dust, which will be in

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about three Hours Time, then glaze it over again; the more you repeat it, the brighter will be your Table; and if you will have it of an exceeding fine Lustre, glaze it over 12 or 15 Times.

*A Chinese Varnish for all Sorts of Colours.*

**P**UT into a Matrafs a Pint of Brandy, one Ounce of Gum Animæ, two Ounces of Mastic, two Ounces of Sandarac or Juniper Gum, powdered together fine in a Mortar; when you have put all together into the Matrafs, close it up, and hang it in hot Weather in the Sun for 24 Hours, or so long over a Fire, till the Gum is dissolv'd, and the Brandy is tinctur'd therewith; then filter it through a clean Cloath, and keep it in a Phial clos'd up, you may mix therewith what Colour you please: For Red use Vermillion, for Black use Lampblack or Ivory Black, for Blue use Indigo and White, *Prussian Blue* or Smalt and White Lead, &c.

*How to Varnish Chairs, Tables, and other Furniture; to imitate Tortoise-Shells so as not to be defac'd by Oil or strong Water.*

**F**IRST lay your Work over with a Lac Varnish, of which you have been instructed before; then lay it over again with Red Lead and yellow Pink, well grounded and mix'd up with the said Lac-Varnish; you may do it twice or three times over, letting it be thorough dry every time before you do it: After which rub it with *Dutch* Rushes, such as the Joiners and Cabinet Makers use.

Then take Dragons Blood, which is a red Gum, and may be had at the Druggists, beat it very fine in a Mortar, and temper it with this Varnish: if you will be very nice, wring it through a fine Cloath, and put it up in a Phial for use; the longer it stands the finer will be the Colour: With this you may Cloud your Table or other Work in the best Manner you can: If you go over Clouding it again, you must have a darker Shade; and to deeping your Clouds, you may add to your Varnish a little Ivory Black, Umber, or Indigo, and work the Colours in one another, as your own Mind will best direct. When you have done your Work, and it is thorough dry, then take some Pumice Stone, make



make it red hot, and beat it to a fine Powder; and with this and *Dutch* Rushes, soak'd in Water, rub it smooth and even, and then rub it with a clean woolen Rag; and holding it over a gentle Heat, give it five or six more Lays of Varnish, but be careful you heat it not too much, least it should blister, and spoil your Work; after it is thorough dry, then take Tin Ashes and sweet Oil, and with the rough Side of *Spanish* Leather; polish it; and give it the finishing Stroke with some Tin Ashes and the Palm of your Hand, wiping it so long till it has a fine Lustre.

From this Direction the Ingenious will make further Improvements.

*A very fine Indian Varnish.*

**T**AKE four or five Quarts of good Brandy, distil and rectify it to the highest Degree, that when you light a Spoonful, it will consume itself in the Flames, and leave nothing behind. Having this ready, take Gum Lacca, beat it fine, and put it to the Spirit into a Phial or Matrafs; let the Spirit be four Fingers high above the Gum, close the Glass, by tying a treble Bladder over it, then put it on a hot Sand, and let it stand till the Spirit and Gum is well united and boil'd; but be careful to see whether you perceive some blisters drive up to the top of the Glass, and as soon as you perceive them, take a Needle and prick the Bladder, in order to give it Vent, else your Glass will be in danger of bursting.

After which filtre it through whited brown Paper into another Glass, and keep it clos'd up for Use.

If you will use this Varnish with Colours, let them be first grounded with the rectified Brandy, and then temper as much as you have occasion for present use, with the Varnish, and lay it on your Work; and when you think you have laid your Varnish thick enough, smooth it, when dry, with *Dutch* Rushes; then polish it with Tripoli and sweet Oil; give it one Lay or two of clear Varnish, and it will be fine.

*To Japan with Gold, Glass, or any other Metal Spangles.*

**F**IRST lay on your Work with Lac Varnish; then grind Coln's Earth and Gumboge with the same; this

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this Varnish must be bright and clear: with that Colour lay your work also once or twice over; let it dry, and then do it over with Varnish only, and sift the Gold Dust, or what else you design to do it over with. If your Work or Table is large, you lay the Varnish on one Place after another; for the Varnish would dry in one Place before you have done sifting the other. And after you have sifted your Work all over, and it is thorough dry, then give it 12 or 16 Lays more of clear Varnish, after which smooth and polish it as directed.

*A very fine Varnish for a Violin.*

**T**O make this to Perfection, you must have three Glasses before you: In the first you put of the finest Gum Lacca eight Ounces, Sandarac three or four Ounces, both very finely pulveriz'd; upon this pour of the best rectified Spirit of Wine, so much till it stand four Inches above the Ingredients when dissolv'd, strain it through a Cloath, and put it closed up in a still Place to settle; in a few Days the Top will be clear, which decant off into another Glass, and preserve it from Dust.

In the second Glass put of Dragon's-Blood five Ounces, and of Red Wood three Ounces, dissolve and extract it with the same Spirit of Wine.

In the third Glass dissolve of *Colophoni* three Ounces, *Aloe Succotrine* two Ounces, *Orlenii* 3 Ounces; and when altogether is extracted, then pour the Matters of the three Glasses into one, close it up, and let it settle; then pour off what's clear at Top, and filter the rest through a brown Paper. If you find the Varnish too thin, exhale it a little over a gentle Heat, and you will have a fine Red Varnish, which will gild Pewter, and be of extraordinary Use for varnishing of Violins, &c.

*A choice Varnish which cannot be hurt by Wet.*

**T**AKE Gum Capall, as much as you please, beat it fine, put it into a Glass, and pour of high rectified Brandy four Inches high over it; then close the Glass with a Bladder, set it for 24 Hours on a warm Oven for the Gum to dissolve, after which put the Glass in *Palm. Mar.* till the Spirit and the Gum is united.

*A fine*

*A fine Marbling on Wood, or Japanning.*

**T**AKE of the best transparent yellow Amber what Quantity you please, beat it to a Powder, put it in a clean Crucible which is glaz'd within, let it melt over a gentle Charcoal Fire, and stir it well, to keep it from burning; then pour it upon a smooth, clean Marble Table, let it cool, and beat it again to Powder. Take afterwards clear Turpentine, and in a Glas warm it in hot Sand, put in it the beaten Amber, let it boil and dissolve gently together, till it is of a Consistence fit to be used with a Pencil, strain it through a Cloath and you will have the finest Lac Varnish that can be had; and although it is of a brownish Colour, yet when laid on, it has a fine clear Gloss.

The Colours wherewith you marble, are the following; Lampblack, Brown-red, Oker, Vermillion; these four are ground with Linseed Oil: Venice White Lead is ground with Nut Oil.

For a White, lay your first Ground with Linseed Oil, and if there are any Holes in the Wood, fill them up with Calk, tempered with Size. For a black Ground lay it first with Lampblack and Size; when the Ground is dry, mix the Vermillion with the before describ'd Lac Varnish, and with a Brush Pencil lay it on with an even and quick Hand; repeat this three or four times, till it is bright and fine, and lay the Varnish by it self over it twice or thrice: Then mix your other Colours with the Varnish in an Oister-Shell, or in little Cups, and with them Marble upon whar ground you have prepared, in Imitation of whatever you design.

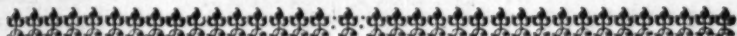
*A fine Gold Varnish, wherewith one may gild silver'd or tinn'd Things, with so much Lustre as if done with Gold.*

**T**AKE of the finest Gum Lacca in Grains eight Ounces, clear Gum Sandarac two Ounces, Dragon's Blood one Ounce and a half, Colophonium or black Rosin one Ounce and a half, beat all together into Powder, and put it into a Quart of high rectified Spirit of Wine, which is strong enough to light Gunpowder; put it in warm Sand over a Smallcoal Fire, let it boil for two Hours (if you can do it

in

in a *Baln. Mar.* it is better) or so long till it is dissolv'd as much as possible, then let it cool; wring it through a Cloath into a Glass, so as to separate the Dross that might have been in the Ingredients; this you lay on over any Thing that has either been silver'd or tinn'd, three or four times, and it will resemble the brightest Gold. If you will have the gold Colour still higher, you only add about two Grains of Gurgummi, two Grains of the best Aloepatica, and one Grain of the finest Dragon's Blood, boiling it up, and straining it through a Cloath into another Glass.

When you use it, put the Glass into a Bason with Water over a gentle Charcoal Fire, in order to make the Varnish fluid; it is also requisite to warm the Work before you begin to varnish it.



### Of CORAL WORK.

*To make Red Coral Branches, for the Embellishment of Grotto's*

**T**AKE clear Rosin, dissolve it in a Brass Pan; to one Ounce thereof add two Drams of the finest Vermilion; when you have stirr'd it well together, and you have chose your Twigs and Branches, peal'd and dry'd, take a Pencil and paint these Twigs all over, whilst the Composition is warm, and shape them in Imitation of natural Coral of a black Thorn; when done, hold it over a gentle Coal Fire, turn the Branch with your Hand about, and it will make it be all over smooth and even, as if polish'd.

In the same Manner you may with white Lead prepare white, and with Lampblack, black Coral.

A Gentleman may with very little expence build a Grotto of Glass Cinders, which may be easily had, Pebbles, or Pieces of large Flint, and embellish it with such counterfeit Coral, pieces of Looking Glass, Oyster, Muscle and Snail-Shells, Moss, pieces of Chalk, Oar, &c. The Cement to bind and Cement them together, you have Direction how to prepare under the Article of Cements.





## P A R T VI.

The Art of Preparing Colours for PAINTERS,  
LIMNERS, &c.

## I. Of BLUE-COLOURS.

*To make or prepare Ultramarine.*



**T**AKE of Lazur-Stone or *Lapus Lazuli* the blue Veins, calcine them in a Crucible on a Charcoal Fire, and quench them in Vinegar, this repeat twice; then grind them on a fine hard Stone to an impalpable Powder.

When it is thus ground, then take white Rosin, Pitch, new Wax, Mastick and Turpentine, of each six Ounces; Frankincense and Linseed Oil, of each two Ounces; let it altogether dissolve over a gentle Fire; stir it well with a wooden Spatula, in order to unite them together; then pour it into clean Water, continually stirring it, take it out, and preserve it from Dust for Use.

When you go to prepare your Ultramarine, take to each Pound of the pulveriz'd Ultramarine 20 Ounces of the Mafs. The Mafs you dissolve before a gentle Warmth by Degrees, in a Pipkin, and fling the Powder in it by little and little, whilst it is dissolving; after your Powder is all in, and well incorporated with the Mafs, then pour it into a Pan with cold Water, form it into little Tents or Drops; but to prevent its sticking to ones Fingers, you must anoint them with Linseed Oil; those Tents or Drops you lay again into fresh cold Water for 15 Days, shifting the Water every other Day.

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Then take and put them in a clean earthen well glaz'd Cup or Bason, and pour warm Water on them; when that is cold, pour it off, and put fresh warm Water to it; this you repeat till the Tents or Drops begin to dissolve, which will then turn the Water into a blue Colour.

When the Water is of a fine blue Tincture, and cold, then pour that into another clean earthen Cup or Bason, and pour more warm Water upon the remaining Tents; when that also is colour'd, pour it off, and fresh on, repeating this till the Water receives no more Tincture.

Let the tinctur'd Waters stand for 24 Hours to settle, after which you will see a Greasiness on the Surface; which, with the Water together you pour off gently, and put fresh clean Water upon the Settling, stirring it well together, and pouring it through a fine Hair Sieve into a clean Bowl; the Sieve will attract some of the slimy or greasy Matter, that might remain in it; and after you have wash'd your Sieve, and repeated the next Settling, pouring it through with clear Water, three Times running, then let it settle; pour off the Water, and let it dry of itself. Thus you will have a fine Ultramarine.

*To prepare a curious Blue Colour, little inferior to Ultramarine, out of Blue Smalt.*

TO do this you grind your Smalt very fine, and proceed in every Respect as you have been taught before, in preparing of Ultramarine

*To prepare a curious Blue Colour out of Silver.*

**H**AMMER Silver very thin, Neal it thoroughly, and quicken or anoint it a little over with Quicksilver; then put of the sharpest distill'd Vinegar, in which you have dissolv'd some Sal Armoniac, into a Glass; hang the Silver Slips over it, so as not to touch the Vinegar; cover it very close, and put it into a warm Place, so that thereby the Fumes of the Vinegar may be raised a little, which extract out of the Silver a most beautiful Ultramarine, and hangs itself upon the Silver Slips; wipe them off into a Shell, and hang the Silver Slips over the Vinegar again, well closed; repeat this till all the Tincture is drawn out of the Silver.

*Another*

*Another Method to extract a fine Blue out of Silver.*

**T**AKE of the finest Silver as much as you will, 7 or 8 Ounces, and dissolve it in a clear and strong Spirit of Nitre; then draw off Half of the Spirit of Nitre, and set the Glass in a damp and cool Place, and the Silver will over Night shoot in fine Crystals, not unlike Saltpetre; then pour the Spirit of Nitre clear from it, put the Crystals into Glass Plates, and let them stand in a warm Place till they fall into Flower; then grind it with as much clear Sal Armoniac, which is sublim'd over common Kitchin-Salt, set it together in the open Air, till you see the Mass turns of a blue or greenish Hue; then put it together into a Cucurbit with a large Head to it, and sublime it, and the Sal Armoniac will carry the *Anim. Lun.* up along with it; after this grind the Silver that's left at the Bottom of the Matrafs with fresh Sal Armoniac, and sublime it as before; this repeat till all the Animus, or the fine blue Tincture is drawn out of the Silver: The Water you evaporate over a gentle Fire, and you will recover your Sal Armoniac again; the Tincture you dry and preserve. It is a fine and beautiful Colour, fit to be used for the most curious Painting or Limning.

*Another Method.*

**T**AKE of the finest Silver as much as you will, beat it very thin; and with four Times as much Quicksilver make it into an Amalgama, wring it through a Leather, and drive all the Mercury afterwards from it; thus you will have a fine Silver Calx, which dissolve in clear Aqua Fortis, the Quantity whereof must be as little as possible; when it is dissolv'd, let the Water evaporate, and the Silver will remain at the Bottom like damp Ashes; pour over it some Sal Armoniac mix'd with sharp white Wine Vinegar, let it settle and clear; then pour off the Vinegar, and keep the Settling at the Bottom for a Month well clos'd up, to prevent the least Evaporation, and you will find a very curious blue Colour.

*To prepare a Blue Colour out of Verdegrease.*

**T**AKE Sal Armoniac and Verdegrease, of each six Ounces, mix it with Water of Tartar well together into a Paste

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a Pafte, put this into a Phial, and ftop it clofe ; let it ftand for feveral Days, and you will have a fine blue Colour.

*Another Method.*

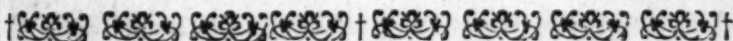
**T**AKE Sal Armoniac one Part, Verdigreafe two parts, beat them both to a Powder, and mix it with a little white Lead ; then incorporate it together with Oil of Tartar, put it into a Glafs and clofe it well ; put it afterwards in a Loaf and bake it in a Baker's Oven ; as foon as the Loaf is bak'd enough, your Colour will be ready.

*Another Method to prepare a fine blue Colour.*

**T**AKE Quickfilver two Parts, Sulphur three Parts, Sal Armoniac four Parts, mix and beat it all well together, temper it with Water, put it into a well glaz'd Pipkin into a Furnace, over a Coal Fire, and when you fee a blue Smoak arife, take it off and let it cool, then break the Utenfil, and you will find a fine Sky Blue, not unlike *Ultramarine*.

*To make Venice Sky Blue.*

**T**AKE Quick-Lime one Pound, mix and work it with fharpe White-Wine Vinegar into a Dough ; let it ftand for half an Hour, and when hard, pour more Vinegar to it, in order to make it foft ; when done, add to it two Ounces of pulverifed fine Indigo, mix it firft well together, fet it into a Glafs Veffel for 20 Days under a warm Mift, after which time fee whether it is of a fine Colour ; if not, fet it again as long as before in the Mift, and it will then come to its Perfection.



## II. Of feveral RED COLOURS.

*To make fine Lake out of Cochineal.*

**T**AKE Cochineal eight Ounces, Alum one Pound, fine and clean Wool eight Pound, fine powdered Tartar half a Pound, Bran of Rye eight Handfuls ; boil the Bran in about three Gallons of Water, more or lefs, it is



no great Matter; put it over Night to settle, and pour it through a Flannel to have it clear and fine; then take a Copper Kettle, large enough to contain the Wool; pour half of the Bran Water and half clean Water to it, so much as you think sufficient to boil the Wool in it; let it boil, then add the above Tartar and Alum to it, and put in the Wool; let it also boil for two Hours, turning all the while the Wool up and down, in order to cleanse it thoroughly; after it has boil'd that Time, put the Wool into a Net, to drain out the Wet: Take then the other half of the Bran-Water, and pour to it as much clean Water, and let it boil; after it is well boiled, put in Cochineal, which before must be ground very fine with four Ounces of white Tartar; you must stir it continually about, whilst it is boiling, to prevent its running over; then put in the Wool, and let it boil for an Hour and a half, keeping it all the while turning about; after the Wool has attracted the Colour, put it again into a Net, let the Wet drop off, and you will have it of a Scarlet Colour.

This Colour may indeed be done in another Manner, and of a brighter Lustre, in a Pewter Kettle, with Tin and Aqua Fortis, but the above Method is sufficient for the purpose design'd, and may be made by Anybody, without the Implements which are requir'd to dye it the other Way.

*To extract the Lake out of the Scarlet Wool.*

**T**AKE clean Water about six or seven Gallons, dissolve therein as much Pot Ashes as will make it a good sharp Lee, filtrate it through a Filt or Flannel Bag to make it very clear; in this put the Wool, let it well boil in a Kettle, till it is white again, and the Lee has contracted all the Colour; then pour it again through a clean Filt or Bag, and squeeze out the Wool; take then two Pound of Alum, let it dissolve in Water and pour it in the colour'd Lee; stir it well together and it will curdle and turn to a thick Substance of a PASTE, pour it again into a clean Bag, and the Lake will remain in the Bag, but the Lee will run clear from it; and in case it should still run colour'd from it, you must let it boil with a little of the dissolv'd Alum, which will wholly curd it, and keep the Lake back.

When the Lake in this Manner is in the Bag, you pour clear Water over it, in order to clear it from the Alum or Salt that might still remain in it, and take a Plate of Plaster of

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Paris, or Chalk, pour the Lake through a Paper Cone that has a small opening at the Point, in little Drops or Tents upon it, and when dry, put them up for Use.

You must observe, that in Case the Liquid should fall short in boiling the Wool, you must recruit it, not with cold, but with warm Water.

If you can get the Sharings of Scarlet Cloath, you will save your self much Trouble, by only boiling them in the Lee, and proceeding as has been directed.

*Another Method.*

**T**AKE Lee of Ashes or Tartar, to this put a little dissolv'd Alum, and pour it in a wide Glass Utenfil; then take Cochineal, put it into a close Linnen Bag, and swing it backwards and forwards in the Lee, till all the Colour is extracted; then take lukewarm Alum Water, pour as much into the Lee as will curdle it; pour the curdled Lee through a Flannel, sweeten it off with clear Water, then you dry the Colour on a Piece of Plaister of Paris, as before directed.

*To make fine Vermillion.*

**T**AKE two Parts of Quicksilver, and one third of Sulphur, put it into a Pipkin, and melt the Sulphur and the Quicksilver together; when it is cold, then grind it well upon a Stone, and put it into a Glass, which beforehand has been laid over with a Coat of an Inch thick; then make a Coffin of Clay for the Glass to stand in, set this on a Trivet, first over a slow Fire; put a Cover of Tin, with a little Hole in the Middle upon the Glass, and lute it all round; put an Iron Wire through the Hole, for to stir it about, augment your Fire by Degrees, and watch your Glass carefully; for you will see several colour'd Smoaks proceed from the Matter in the Glass, but keep on augmenting your Fire, till you see the Smoak comes out of a red crimson Colour, then it is enough; take off the Fire, let it cool, and you will have a fine Vermillion.

Before you use it to paint or write therewith, take as much Vermillion as you will, and grind it well with good White-Wine on a Stone, and after that with the White of Eggs; add a small Matter of Aloepatica to it; make it

up in little Cakes, and when dry, put them by for Use. When you use them, grind or dilute them with clear Pump-Water, and a little White of Eggs; and if it will not flow readily from the Pen, mix a little Myrrh among it.

*How to purify Vermillion.*

**T**HE Vermillion being made of Mercury and Sulpher, the Impurities which it has contracted of those Minerals must be substracted, and this is done in the following Manner:

Grind the Pieces of Vermilion with Water upon a Stone, and put it on glaz'd Plates to dry; then pour Urin upon it, and mix it thoroughly with it, so that it may swim over it; let it thus stand, and when the Vermillion is settled, pour off that Urin, and put fresh upon it; let that stand over Night, repeat this four or five Days successively, till the Vermillion is well cleansed; then pour the White of Eggs over it, mix it up therewith, and stir it well together with a Spatula of Nut-Tree; let it stand again, when settled pour it off, and put fresh on; repeat this three or four Times, covering your Utensil every Time close, to keep the Dust from falling into it, which else would take off the Beauty of the Colour: When you use this Vermillion, dilute it with Gum-Water.

*Another Method.*

**G**RIND the Vermillion with the Urin of a Child, or Brandy, and set it to dry in the Sun.

If you will have the Vermillion of a high Colour and free from its black Hue, then put into the Brandy or Urin a little Saffron, and grind your Vermillion with it.

*To make a fine Purple Colour.*

**M**E<sup>L</sup>T one Pound of Tin, after which put two Ounces of Quicksilver to it; stir it so long together, till it is an Amalgama; then take Sulpher and Sal Armoniac, of each one Pound, grind it fine, and mix it up with the Amalgama, in a Stone-Mortar, or wooden Bowl; put it into a Glass, which is well coated with Clay, set it first over a gentle

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gentle Fire, and augment it by Degrees, so as to keep it in one Motion; stir the Matter with a Stick, and when you perceive it to be of a yellow Colour, take off the Fire, and let it cool, and you will have a fine Gold Colour, besides a beautiful Purple.



### III. Of all Sorts of COLOURS extracted from Flowers, &c.

*How to extract a Yellow, Blue, Violet, and other Colours.*

**P**REPARE a middling sharp Lee out of Lime, and Soda or Pot-Ashes, in this boil the Flowers or Leaves of single Colours, over a slow Fire, so long till the Tincture of the Flower is quite extracted, which you may know when the Leaves turn pale, and the Lee is of a fine Colour. This Lee put afterwards in a glaz'd Pipkin or Pan, and boil it a little, putting in some Roach Alum; then pour the Lees off into a Pan with clean Water and you will see the Colour precipitate to the Bottom; let it well settle, then pour that Water off, and pour on fresh; this you repeat till the Tincture is entirely cleans'd from the Lee and Alum, and the freer it is thereof, the finer will be your Colour. The Settlement is a fine Lake, which you spread upon Linnen Cloaths, and lay them on clean Tiles in the Shadow to dry.

You may dry your Colours upon a Plate of Plaister of Paris, or for Want of that on a Piece of Chalk; either of them will do better, and dry the Colours quicker than the Method taught before.

To the Receipt for extracting the Tinctures out of Flowers, Leaves, Herbs, and Plants, by Distillation, which has been already inserted p. 143. I only add, that it will be adviseable to preserve the first Droppings of the Extraction that fall into the Receiver, by themselves, they yielding the finest and most beautiful Colour. Care must be also taken, not to bruise the tender Leaves of the



Flowers, else the coarse Juice will distill along with the Tincture, and make it of an unpleasant Hæc. Such Leaves that are firm and strong, require not that Care.

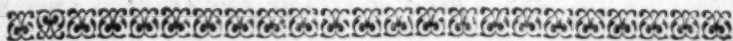
*Mr. Kunkel's Method of extracting the Colours out of Flowers, &c.*

**I** Take, says he, high rectified Spirit of Wine, which is without any Phlegm, and pour it over a Herb or Flower, which I will, and if the Leaves of Plants are large and coarse, cut them small, but I leave the Leaves of Flowers whole; as soon as I perceive the Spirits tinctur'd, I pour it off, and put on fresh; when that is tinctured, and I find both Colours of an Equality, I put them together; but if they differ, I put each separate by itself, after which I distill the Spirit of Wine from it, to a very little, so that I may take it out of the Cucurbit, and then put it into a China Tea Saucer, a Glass Cup, or a small Matraass, and let it evaporate over a slow Fire till it comes to some thickness, or, if you will, quite dry; but this must be done very slowly, on Account of the Tenderneſs of the Colour.

Some Flowers will change their Colours and produce quite different ones, and this the blue Flowers are most subject to; to prevent which, one must be very slow and careful in distilling them: I have never had so much Trouble with any other colour'd Flowers as the Blue ones, and yet, I cannot boast that I have obtain'd a blue Colour from Flowers to my Satisfaction. The whole Matter depends chiefly upon Care; Practice will be the best Teacher.

By this Method one may presently see what Flowers or Plants are fit for Use, for by only infusing some in a little Spirit of Wine, it will soon shew what Colours they will produce.





## IV. Of GREEN COLOURS.

*How to make good Verdegreafe.*

**T**AKE Sharp Vinegar, as much as you will, clean Copper Flakes, one Pound, Salt three Quarters of a Pound, red Tartar eight Ounces, Sal Armoniac two Ounces, Leven twelve Ounces; beat what is to be beaten to a fine Powder, and mix it all with the Vinegar well together; put it into a new well glaz'd Pan, cover it with a Lid, and lute it with Clay; then bury it for 14. or 20 Days in Horse-Dung. Take it out again, pour off the Vinegar gently, and you will have good Verdegreafe.

*Another.*

**T**AKE a well glaz'd Pan or Pot, put into it good sharp Vinegar, then take of thin Copper Slips a pretty large Quantity, put them into a Crucible, and set the same into the Pan with Vinegar, so that the Vinegar may not touch the Copper; then lute the Cover well with Clay to keep out the Air; thus put the Pan in'o Horse Dung, or into a warm Place, for 25 Days; then take it out again, open it, and you will find the Verdegreafe hang to the Copper Slips; scrape the Verdigreafe with a Knife off the said Slips, and let it fall into the Vinegar; after which, close up the Pan again as you did before, put it into the Dung or a warm Place, and thus repeat it till the Copper is all consum'd: The Verdigreafe will settle at the Bottom of the Pan, which, after you have gently poured off the Vinegar from it, you may put up for Use.

*Another easier Method to make Verdegreafe.*

**T**AKE a Copper Kettle or Bowl, put into it good sharp Vinegar; set it in the Heat of the Sun to dry, and you will have fine Verdegreafe; after you have taken it out of the Kettle or Bowl, you may pour more Vinegar, and repeat it as often as you think proper.

*To make a fine Verdegreafe for Dyers.*

**F**IRST take four Pound of Tartar, two pound of Salt, one pound of Copper-Ashes, one pound and a half of good Vinegar; then take a Crucible or an unglaz'd Pan, take an Handful of Tartar, and fling it into the Crucible, also one Handful of Salt, and a Handful of Copper Ashes; fling all in one after another, till the Crucible or Pan is full; then pour on the Vinegar, and stir it well together, till the Ingredients are thorough wet, and are turned to a black Colour; cover the Pan, and lute it close with Clay, to prevent the Air coming to it; put it for a Fortnight or three Weeks in hot Horfe-Dung, and you will have good Verdegreafe. If you will have it dry, hang it up in a Bladder in the Air.

*Another Method.*

**T**AKE Vinegar in which has been steep'd some Copper, and one Pound of sear'd Salt; mix the Salt with so much Vinegar as to make it of a Subtance; then put it into a Copper-Vessel, close it up, and put it in a damp Place; and after it has stood some Days, you will have a good Verdegreafe.

*Another Method.*

**T**AKE an old Kittle or Copper, and scour it clean with Sand; then take Vinegar and Honey, of each an equal Quantity, mix it together, and strike it all over the Inside of the Kittle; then take sear'd Salt, and sprinkle it upon the Honey, so as to stick to it; have a Board, made with a good many Holes, and cover the Kittle therewith; then turn your Kittle with the Board upon hot Horfe-Dung; cover it all over with the Dung, and let it stand for eight Days together, and you will find a fine Verdegreafe.

*A fine Verdegreafe for Limners.*

**T**AKE Copper-Slips or Filings, put them into a strong Copper-Box, with a Cover to it; pour some Vinegar mix't up with a little Honey, into it; set it in the Sun, or in a warm Place for fourteen Days, and the Vinegar will be  
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turn'd Blue; which pour into a Glass, and close it well up; then put more Vinegar and Honey upon the Copper-Filings, and proceed as before, till they don't tincture the Vinegar: What you have gather'd up in Glasses, put in the Sun or a warm Place, till it becomes of a proper Thickness; then grind it on a Stone, and temper it with a little Gum-Water: If you will have it of a Grass-Green, mix it with a little Sap-Green.

*How to make Sap-Green.*

**A**BOUT a Fortnight or three Weeks before *Michaelmas* take as many Slows as you please, mash them a little, and put them into a clean glaz'd Pan; sprinkle them well over with powder'd Alum, and let them stand in a hot Place for 24 Hours; then pour upon them a clear Lee, put it upon a Fire, and give it a slow Boiling, so long till it has boild away a good Quantity; then take it off the Fire, let it cool, and pour it through a Cloath; what comes through it, put up in a Bladder, and hang it in the Air to dry; afterwards keep it always hanging in a dry Place, or in the Chimney-Corner; and when you have occasion to use it, take as much as you want and dilute it with clear Water: If it should turn too much upon the Yellow, mix it with a little Indigo.

*Another finer Sap-Green.*

**T**AKE of blue Lilies that Part of the Leaf which is of a fine blue Colour, for the rest is of no use, and stamp them well in a Stone-Mortar; then put upon them a Spoonful, or according to the Quantity of the Leaves, two or more Spoonfuls of Water, wherein before has been dissolv'd a little Alum and Gum-Arabick, and work it well together in the Mortar; then strain it through a Cloath, put it in Muscle-Shells, and set them in the Sun to dry.

*Another Method.*

**A**FTER you have proceeded as before, sling some powder'd Quick-Lime over it, before you strain it in a Cloath, and put it up in Muscle-Shells.

*Another*



*Another Method.*

**B**EAT the blue Leaves of Lilies in a Stone-Mortar, strain it through a fine Cloath into Muscle-Shells, and fling some powder'd Alum over it, to one more than another, in order to make the Colour of different Shades.

*To prepare a fine green Colour.*

**T**EMPER Indigo and yellow Orpiment with Gum-Water; grind it fine, and mix with it a little of Ox- or Fish-Gall, and you will have a pleasant Green. You may shade it with Indigo or Sap Green, and heighten it with Dutch Pink.



## V. OF WHITE COLOURS.

*To make fine White Lead.*

**T**AKE some cast Sheet-Lead, cut it into Plates of about two Inches wide, and six or eight Inches long, make thro' each of them a Hole, to draw a String through; then have an oaken Vessel, about two Foot high, into this put two Quarts of good Vinegar, and a Handful of Salt; hang your flatted Leads over the Vinegar in the Vessel, and cover it; set it over a gentle Coal Fire, so long till it is boiling hot; then take it off, and put it for ten Days in a warm Place; then take off the Cover, take out the Leads, which will be covered with a white Colour on both Sides, a Finger's thick, which you scrape off with a Knife, put it into a clean Bason; then hang the Leads again in the wooden Vessel, and proceed as before, scraping the Colour once every ten Days; grind the Colour in a Stone-Mortar with clean Water to a Paste, and put it up in clean Pans to dry.

*Another*

*Another Method to make White Lead.*

**T**AKE long and flat Pieces of Lead, hang them in a glaz'd Pan, or rather in an earthen square Vessel, which is pitch'd the Inside; but before you hang the Lead in the Vessel, pour in it good Vinegar, heated; cover it close, lute it to keep out the Air, and put it in a warm Place for a Month or five Weeks; then take off the Cover, and scrape the White Lead which hangs about the Lead; this you repeat every Fortnight or three Weeks, and you will have good White Lead.

*To prepare another white Colour.*

**T**AKE Quick-Lime, mix with it calcined Egg-Shells; grind these two Ingredients with Goat's-Milk very fine, and it is fit to paint withal.

*A good white Colour.*

**T**AKE Crown-Glass, and beat it to an impalpable Powder; take also fine pulveriz'd Sulphur, mix it together in a Pan with a Cover to it, lute it close, and put it upon a Charcoal Fire, so as to make the Pan red hot all over: When it is thus heated, take off the Fire, and let it cool; then take off the Cover, grind the Matter upon a Stone with clear Water, and temper it with either Oil or Gum-Water: It will give a good white Colour.

*A fine white Colour, for Painting in Miniature.*

**T**AKE four Ounces of good Bismuth, and beat it fine; then dilute it in eight Ounces of the best clarified Aqua Fortis, pour the Dissolution into a Glass, and put a little Salt-Water into it, and the Bismuth will precipitate to the Bottom, in a Snow-white Powder; pour off the Water, sweeten the Powder well with clean Water from the Sharpness of the Aqua Fortis; then dry it, and keep it carefully from Dust: When you use it, dilute it with Gum-Water.

*How*

*How to refine White Lead extraordinary fine.*

**T**AKE fine White Lead, grind it upon a Stone with white-Wine Vinegar, and it will turn black; then take an earthen Dish full of Water, wash your grounded White Lead well, and let it settle; then drain the Water gently from it, grind it once more upon a Stone with Vinegar, and wash it again; this repeat three or four Times, and you will have a curious fine White, that's fit for the nicest Work, both in Oil and Water Colours.

*How to prepare the Egg-Shells for White.*

**S**OAK the Egg-Shells three or four Days in good sharp Vinegar; then wash them in clear Water, dry them in the Heat of the Sun; beat them to a fine Powder, and grind them on a Stone.



## IX. Of several BLACK COLOURS.

*To burn Lampblack, in order to make it finer, and of a better Colour.*

**T**AKE a Fire-Shovel, hold it so long in the Fire till it is red hot; then fling your Lamp-black upon it, and when it has done smoaking, it is enough.

*How to make a finer Lampblack than what is ordinarily sold in Colour or Chandler Shops.*

**H**AVE a Lamp with a large Wick of Cotton, stor'd plentifully with Oil; fix over the Lamp a Sort of Canopy, made of Tin or Iron; the Smoak which settles to it, sweep off with a Feather, and preserve it from Dust. When you use it, temper it with Oil or Gum-Water.

*Black*

*To make a Black of Trotter-Bones.*

**T**AKE as many Trotter-Bones as you please, burn them in a clean Crucible, and quench them in damp Linnen Rags; grind them with fair Water, before you use Gum with it: This Black is fit to be mix'd with Lake and Umber for Shades, in Carnation or Flesh Colour.

*To make Ivory-Black.*

**T**AKE the Shavings or Raspings of Ivory, which you may easily have at the Comb-Makers; mix them up with a little Linseed Oil, put them into a Pan or Crucible, and lute it close, leaving only a little Hole in the Middle of the Cover; set it in a Coal Fire, and let it stand till you perceive no more Smoak; then take it off, and set it in Sand, putting another Pan or Crucible that's entire, over it; when cold, you will have the finest black Colour that can be prepared.

*Another Method to burn Ivory either Black or White.*

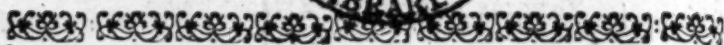
**F**ILL a Crucible with the Wastes of Ivory, or Harts-Horn, lute it well, and put it in a Fire, and when the Phlegm, Spirit, Oil, and fluid Salts have left them, they will be of a very fine black Colour; but if you keep them longer in the Fire, they will turn as white as Snow.

*A Cherry-Stone-Black.*

**F**ILL a Crucible with Cherry-Stones, cover and lute it well; let them first dry by Degrees, then burn them to a Coal; afterwards beat them to Powder, and moisten it with Gum Dragant Water; form it into little Balls, and they are ready to be used when Occasion serves, either for Oil or Water-Colours.







### Several Methods of GILDING.

*A particular Way of Gilding, for such Painters or Gil-  
ders as are oblig'd to perform it in the open Air,  
where the Leaf Gold cannot be manag'd, on Account  
of the Wind.*

**T**AKE thin Pewter Leaves, strike them over with a Gold Ground, or Gold Size, and when you are oblig'd to gild any Thing that's high, and you have no shelter to keep off the Wind, you lay only the Size on your Work something stronger, in order to make the Pewter gilded Leaves stick on the better.

*How to gild upon Wood, Picture Frames, or any other  
Sort of Work.*

**T**HE Wood must be first well smooth'd, then twice or thrice struck over with Size made out of the Shreds of Glove Leather, and grounded nine or ten Times over with Chalk; when it is dry, rub it well over with *Dutch* Rushes, to make it even and smooth, then with a soft Hair Pencil lay it over with Size Water; after which lay on the Gold colour'd Ground, twice or three times; when it is thorough dry, rub it over with a Linnen Rag, till it looks polish'd; then have your Leaf Gold ready cut upon a Leather Cushion, and when (with a large Pencil, dipp'd in the strongest Brandy you can get) you have gone over your Work, be quick to lay on the Gold; when it is quite dry, polish it with a Tooth.

*How to prepare the Size for the Use just now mention'd.*

**T**AKE two Pound of Cuttings or Shreds of white Glove Leather, let it soak for some time in fair Water, and then boil it in a Pot with 10 Quarts of Water; let it boil to two or three Quarts, then strain it through a Cloath into a clean earthen Pan: You may try whether the Size is strong enough

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enough, by taking a little between your Fingers, to see whether it is of a gluish Substance, and whether it will stick.

*To prepare the White Chalk.*

**W**HEN you have made the Size, then take white Chalk, scrape it fine with a Knife, or grind it upon a Stone; and when you have dissolv'd your Size over a Fire, and it is made hot, put in so much Chalk, as will make it of the Substance of a thick Paste; keep it standing for a quarter of an Hour, and then stir it well about with a hard Brush Pencil; add to this White Colour some more Size, and after you have mix'd it well and brought it to a proper Temperature, lay it on your Wood which you design to gild, by daubing it all over with a broad Pencil; and when you have done, let it thoroughly dry, before you lay on another Ground. This you must repeat 10 or 12 Times.

When you have done laying on your Gold Ground then with a soft broad hair Pencil, moisten'd with clear Water, go it all over, in order to smooth your Ground, and when dry, rub it, over with *Dutch* Rushes, or a Piece of new Linen, smooth and fine.

*How to Brunz or Metallize Images of Plaister of Paris.*

**T**AKE Ifinglass, steep it in very strong Brandy, put it well clos'd in the Warmth, and it will dissolve; add to it a little Saffron, and mix it up with Metal Powder in a Muscle or Oyster-shell, this strike over your Image with a soft Hair Pencil; but before you do this, you must first strike it over with Size-Water, mix'd with a little Red Lead.

*How to prepare the Norimberg Metal Powder of mix'd Colours, which gives a beautiful Lustre when strew'd upon Writings or Letters.*

**T**AKE the Filings of Copper, Brass, Iron, Steel, or any other Metal, scarce it through a fine Sieve, and put it into a clean Basin or such like Utensil, wash it well with a clear and sharp Lee, and when you have pour'd that off, wash it with clean Water, so long till you have cleans'd it from all its Soil.

After

After your Filings are thus cleans'd and dry, then take a smooth Plate, either of Iron or Copper, lay it upon live Coals, and put one Sort of the Filings upon the Plate, stirring it continually about with an Iron Spatula: As soon as the Metal is touch'd with the Heat, it changes into varieties of Colours, and that which suffers the greatest Heat, will contract the darkeſt Colour, each Metal a different Sort.

When you thus have done one Sort, proceed in the ſame Manner with another, by which means you will have varieties of Colours.

Then take a Platting-Mill, ſuch as the Silver Wire Drawers uſe, or thoſe who are employ'd in plating of Gold, Silver or Copper Plate, which muſt be fitted with a Sort of Funnel a-top, through which the Filings may be convey'd to the Platting Rolls, which ought to be very exact and parallel to each other, made of the fineſt Steel, and poliſh'd like a Looking Glaſs. When you are thus prepared, work it with Carefulneſs between the Rolls, and you will have a moſt beautiful Powder, which ſparkles with all manner of Colours.

The Filings of Braſs produce a bright Gold Colour; the Copper a fine red Fire Colour; Iron and Steel all manner of Shades of Blue; Pewter, Marcaſit, and Biſmuth, produce a white Colour.

*To ſpot a White Horſe with Cole black Spots.*

**T**AKE Letharge three Ounces, Quicklime fix Ounces; beat it fine and mix it together; put it into a Pan, and pour a ſharp Lee over it; then boil it, and you will have a fat Subſtance ſwim a-top, with which anoint the Horſe in ſuch Places you deſign to have black, and it will turn to that Colour immediately.

It has the ſame Effect in changing Hair that's red into a black Colour, with only this Difference, *viz.* Take an equal Quantity of Lime and Letharge, and inſtead of boiling it with Lee, boil it only with freſh Water; what ſwims a-top, is fit for Uſe, and will answer your Expectation; what Hairs you anoint with it in the Evening, will be black the next Morning.

*How to dapple a Horse.*

**T**AKE in the Spring the large Buds of young Oak-Trees, mix it among the Horse's Provender, and give it him three or four times to eat, and he will be appled, and continue so a whole Year; the Buds of young Elm-Trees will have the same Effect.



## P A R T VII.

## Of the Nature and Growth of SALTPETER.



**T**HE Earth being naturally inclin'd for the Generation of Saltpeter, there is no Occasion to ascribe the Growth thereof to the Urin and Excrements of certain Animals; for this may be plainly seen in some particular Vegetables, as Wormwood, &c. which although it grows in such Places, where there has been none of such Excrement and Urin, when the Juice thereof is pressed out, will of itself shoot into Saltpeter, as is often experienced by Apothecaries and Chymists. However, it must not be disown'd that the Urin and Excrements, particular that of Sheep, contributes not a little to the Growth thereof.

Saltpeter is of such an increasing Nature, that whatever Place is once impregnated therewith, its Ferments are multiplied to Admiration; and like unto a little Acid or Bitter, will diffuse its Qualities among a large Quantity: Whosoever considers this, will easily conjecture how to assist Nature in the Growth of Saltpeter. Even ocular Demonstration will prove this; for if one only takes a Silver Calx that's taken out of Aqua Fortis, and puts it into a glaz'd Earthen Plate, and therein sweetens it

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with

*How*



with clear Water, one will find that the Trifle of Spirit of Nitre which remain'd in the Calx, and is drawn from it by washing it in clear Water, impregnates the Earthen Plate so, that although the most remains in the Water, yet it ferments in such a Manner, that in a little Time it grows all over and out of the Plate, and causes the Glasing to scale and fall off.

We know, that when Aqua Fortis is stilled of common Salt, the Dreggs thereof will turn into good burning Saltpeter; and more, if for Example you dissolve common Salt in Aqua Fortis or Spirit of Nitre, warm, and set it afterwards to stand in the cold, it will shoot into Saltpeter. From which fundamental Experiments one might try a Fermentation, whereby Saltpeter might be in greater Quantity generated, as indeed some, not without good Success, have made Attempts that Way, and that in different Methods. Some have assisted the Saltpetre Earth, after it has been boiled out, with trifling Means, that in a short Time the Earth has grown rich thereof again, which was, by mixing the Earth, when laid up again, with the Skimming of what was boiled out.

Others dig one or more large Pits in the Earth, and with the Earth flung up, wall it round, for to prevent the Floods of Rain running into it; for which Reason they cover it also with a Roof, to keep it from Rain, but leave it open to receive the Sun Beams and the Air, without Interception. In such Holes they fling all their Sweepings, Ashes of which Lee has been made, as well as others that seem useless, the Remains or Ashes of burnt Straw, Soot out of Chimnies, the Sweepings of Poultries, Pidgeon-Houses, all Sorts of bitter and sharp Vegetables, as Wormwood, Wolfs-Milk, Nettles, Flee-Grais, Sea-Beans, the fallen Fruit in Autumn, or rotten Fruit, the Excrements of Men and Beasts, and any Dung, the Outcasts from Slaughter-Houses, as Hair, Claws, Horns, the Paunch with Dung, Guts and Blood, all Manner of Urin, Suds that have been used in washing, and the like, till the Pit is full; there let it rot for some Years, daily flinging upon it Urin, Brine of Herrings or Meat and such like, till it is rotten; then they cease from flinging any Moisture upon it, and let it lie dry, till they boil the Saltpeter out of it, then they fling the Remains again into the Pit, pouring upon it the Liquor that will not shoot, and so let it lie a considerable Time before they boil it again.

Other

Others have built particular long Vaults under Ground, about three Yards deep, cover'd with Boards or with Roof of Pantiles. The Mortar for it is prepared of three Parts Lime, slackened with Rain Water, which has fell with a North Wind, Sheeps Urin one Part, Sheeps Dung three Parts, all well beat together, and mix'd with common Salt; with this the Vault is built up two Bricks thick, then covered with old Stable Dung; every Fortnight, in the Increase of the Moon, it is water'd all over with North Wind Rain-Water, and Sheeps Urin; and the Saltpetre has shooted out in the Vaults in Fossils.

Another Method for the speedy Growth and Increase of Saltpetre is used, by building a Shed of Deal Boards, as large as one pleases or has Conveniency for; but if possible, in a Place where it may lay open to the four Winds; the Roof is either boarded or thatch'd, but the four Sides are left open: Under this Shed a Lay of Earth is laid, about a Foot high, in four different Heaps; then is poured over it Brine of Salt, Lime mixt with the Urin of Men and Beasts; over this is laid another Lay of Earth, and proceeded as directed before, repeating it till the Shed is near full, and working each Heap gradually tapering up in the Form of a Roof, so that the Wind may the easier penetrate into each Heap; then laying a Coat of Earth over it, the Salt and other Liquids are pour'd over it again: After these four Heaps have stood a Month, they are every third or fourth Day after the new Moon rak'd up with an Iron Rake, about a Foot deep, and moistened with Urin and Saltpetre Water, or Dung-Lee, which is pour'd on out of a watering Pot. After these Heaps, thus prepared, have stood about four Months, they will be twice as rich of Saltpetre as common Saltpetre Earth, and may be boiled out every Quarter of a Year: The boiled out Earth is laid up again under the Shed, work'd up as before; and whilst the last Heap is boiling out, the first is in its Bloom again, and encreases in Riches more and more, so that after a few Boilings, it may be boil'd out every Month. The Conveniency, Dispatch, and Profitableness of this Saltpetre-Work will require to have the Boiling-House in the Middle of the four or more Heaps; but then the Roof of the Shed should not be thatched, for Fear of an Accident: There may be (if the Shed is fill'd with large Heaps) four Coppers fix'd in the Boiling-House, and so contrived that one Fire may serve them all.

I shall here present the Reader with a Scheme for a Saltpeter Garden, which was form'd by *Cardil*, and use his own Direction, which is thus :

Build a Vault about 60 or 80 Yards in Length, or according to what Room you have to spare, four Yards high, and eight broad, on a firm Ground ; let there be two Doors, the one towards the North and the other towards the South, and dress the Top of this Vault like a Garden ; at one End whereof have a little House for a Labourer to live in, who is to look after the Saltpetre Work, and water the Garden every other or third Day, when the Moon is encreasing ; the Water he must save beforehand of a South or North Wind Rain, which is best, and mix it with Urin of Men, Horses, Oxen, Cows, Sheep, &c. flinging into it several Handful of common Salt, and stirring it well together : In the Winter Season, when there is hard Frost and Snow, the Vault must be shelter'd with Boards, and a little Charcoal Fire kept in it, leaving both Doors open ; but this is only to be observed in very hard Winters. When the Vault is thus finished and attended, the Owner thereof will in six or nine Months time find the Saltpetre shoot out in great Quantities, and the oftner the Fossils are broke off, and the Garden nourish'd by watering, the more it will encrease in Growth. It is not to be express'd of what Benefit such a Work is, both for himself and his Generation or Successors.

The Floor and Foundation of the Vault must be ram'd down hard and close ; the Side Walls, half an Ell thick, may be built up with Pebble, Brick, or any other Stone ; but the Arch of the Vault must be done with Bricks, prepar'd in this Manner : Take the Earth for Bricks, work it up with North or South Rain-Water, and Urin, of which you must have a sufficient Quantity ready beforehand ; with this, work and form your Bricks, and burn them like other common Bricks. For Example : Take 12 Barrels of Brick-Earth, four of Lime, two of Salt, one of Saltpetre ; all these well work'd together, moulded and burn'd as usual.

For the Mortar wherewith the Bricks of the Arch of the Vault are joined together, you take four Barrels of Clay, four of Lime, one of Salt, one half of Saltpetre, and half a Barrel of Sheeps Dung, all well work'd together, and pour'd over with the above Rain-Water and Urin, and temper'd to a proper Thickness for Mortar. In the Middle of the Vault, let

an Opening be made, raised like a Funnel, and secured with Iron Bars at Top: After the Vault is thus built and inclosed, you raise a Ground over it about three Quarters of a Yard high, with common putrified Earth; but if it can be mix'd with Excrements or Stable Dung, it is better. This will be sufficient for the ingenious Adventurers to improve upon.

*Another Method for furthering the Growth of Saltpetre, is the following:*

**F**IRST erect Sheds, each of four Posts, nine or ten Foot high, of a proportionable Thickness, six Foot distant from each other, fasten'd with Joices, and thatch'd a-top. When your Sheds are ready, lay fat black Earth, about a Foot high, upon a Level; then fling the following Mixture, about three Inches thick, upon it, which is thus: Take Salt 12 Pound, Saltpetre four Pound, Quick Lime 12 Pound; this well beaten and work'd together, is fit for Use.

After you have covered the first Lay of Earth with this Mixture, then rake it well together with the Earth, and when done, pour over it Dung-Lee and Urin, out of a Gardners Watering Pot; then rake and wet it again a second time.

After this, proceed thus with another Lay of a Foot high, so as to go up tapering, one Lay after another, till it is about six Foot high; then coat it all over with Sheeps Dung.

You must observe to begin this Work with the new Moon; and after your Heap has stood three or four Nights, rake it all afunder, and proceed as you did at first; this you must do in the time of the Increase three or four times, and repeat it for three Months together: In the Decrease of the Moon you let it rest, and after the three Months are expired, you will have a very rich Saltpetre Earth.

Every Shed or Heap must be at least eight Feet Distance from one another, for the Benefit of the Air. After you have several of those Sheds brought to Perfection, you may boil Saltpetre successively; for before you have done with three or four Heaps, the first of them will be ready again to boil, before the fourth is done; and your Earth, the more and oftner it is boil'd, will grow the richer.

N. B. For Watering the Earth, you may, if it can be got, use the Pickle of Herrings, or other Salt-Liquors, Soap-  
Lees



Lee after Cloaths are wash'd in, also Alum and other Liquors that are flung away by Dyers: You must also observe, to lay a Coat of Sheeps Dung over your Heaps every time you have raised them.

Glouber, in his Book, intitled *The Wellfare of Germany*, when he treats of the Growth of Saltpeter, and the Benefit it yields to many poor Families, expresses himself in this Manner:

' In the third Chapter of the first Part, about Concentring of Wood, the Pressing of Wood to boil Saltpeter, is only mention'd; but as Wood is not plenty every where, and as it cannot in many Places be spared, to cut it down for boiling Saltpetre out of it, it may be brought to bear that a large Quantity of Saltpetre may be produced out of the faded Leaves of Trees, as also out of wild Grass that grows under Trees, so as to have no occasion to cut Trees down on that Account. And in such Places where there is a Scarcity of Wood, but a Plenty of Corn, Saltpeter may be prepared out of Straw and Stubble; and there is not a Place in the World which does not afford Matter for the Produce of Saltpetre. Wherefore I cannot neglect to communicate to all good and pious Husbandmen a valuable Art, by which they may provide and lay up a hidden Treasure (which Thieves cannot steal) for their Children, and for a Relief to themselves in time of Distress, thereby reflecting upon God's Providence, and remembering their Tutor. For as in the said Treatise I have taught three choice Secrets, both for rich and poor, great and mean, but they being useless to those who have neither Wine, Corn, nor Wood; I have thought it good, not to be forgetful of those who are destitute of either, and are yet willing to provide for their Wife and Children, with Honesty in the Fear of God, to teach them a beneficial Art, hoping it will attend to the Glory of God, and their own Advantage.

' First, then shall a young Beginner have God before his Eyes, and admonish his Wife and Children (if he has any) to fear God, keep his Commandments, and love their Neighbour. Then shall he determine within himself, to manage his Fortune lest him by his Parents, or which he had with his Wife, with such Caution, Care and Frugality, so as not to diminish, but to increase it every Year; that

‘ that when God should visit him with Sicknefs, or a Charge  
 ‘ of Children, he may have something laid by for a rainy  
 ‘ Day. Besides this, he ought not to lay his Hands in his  
 ‘ Lap, but turn them early and late to labour, and look for  
 ‘ the Blessing of God in his Endeavours. And to such as  
 ‘ have had but a slender Fortune of their Parents, I give  
 ‘ them a Lesson, in what Manner they may lay up a  
 ‘ Treasure for their Children, without much Trouble or  
 ‘ Pains.

‘ In the first Place, let him build a Shed North-East of his  
 ‘ House or Habitation, if it can be done conveniently, else  
 ‘ at any other Place, so that the Sun and Air may come at  
 ‘ it, but the Rain be kept out, in which Shed make a deep  
 ‘ Pit; with the Earth which is flung up, wall it in to  
 ‘ keep out the Rain-Water: After this he shall begin to  
 ‘ gather from Day to Day, from Year to Year the below  
 ‘ specified Things, so long and as much till one time or  
 ‘ other, in Case of Necessity, he is obliged to dig for them,  
 ‘ and to see what God has provided for him, and then reap  
 ‘ the Benefit thereof.

‘ The Things he is to fling in, are all Sorts of sharp and  
 ‘ bitter Plants, which grow in uncultivated Places, Hedges,  
 ‘ and Paths, and are no benefit to Cattle, such as are the  
 ‘ Thistles; Wormwood, the large Stalks of Tobacco, which  
 ‘ (if they are planted) are flung away; also the hard Cab-  
 ‘ bage Stalks and Leaves, and other Things unfit for Cattle to  
 ‘ feed upon; Pine-Apples, if they are to be had, and in  
 ‘ Autumn the Leaves of Trees; also Pidgeons and Hens  
 ‘ Dung, and the Dung of any other Creature. If you can  
 ‘ have Feathers of Poultry and wild Birds, fling them in;  
 ‘ fling also in all the Ashes whereof Lee has been made,  
 ‘ and fit for nothing but to be flung away; also the Chimney  
 ‘ Soot, and from the Slaughters the Blood, if not used for  
 ‘ any thing else; Hogs Hair; Horns and Shoes of Oxen  
 ‘ and Cows; the Bones which the Dogs can’t eat, save  
 ‘ them and fling them in the Pit; and not only the Out-  
 ‘ cast and Scraps that are made in thy own House, but also  
 ‘ (to have the Pit the sooner full) those of thy Neighbours,  
 ‘ if they have no use for it themselves; and thus one may in  
 ‘ one or two Years time fill a large Pit with such Things:  
 ‘ In the mean while the Urin in the House must be saved,  
 ‘ and flung into that Place; and if you can also have it from  
 ‘ your

‘ your Neighbours for that Purpose, it is good; for those  
 ‘ Things in the Pit should be kept always moist, in order to  
 ‘ cause them the sooner to rot. If you can have no Urin,  
 ‘ take common Water or Dung-Lee; but if you can have  
 ‘ Sea-Water or any other Salt-Water, it is better: One may  
 ‘ bespeak at the Fishmongers the Pickle of Herrings, also  
 ‘ the Brine of Salt-Meat; for all the Brine wherein Meat  
 ‘ has lain, turns to Saltpeter.

‘ When you have fill’d the Pit full, and it is well putrified,  
 ‘ wet it no more, but let it lay so long till all is dry. Then  
 ‘ if you have occasion for Money, look out for a Saltpetre  
 ‘ Boiler, and bargain with him what you shall give him to  
 ‘ lee, boil, and sell your Saltpeter. When he has done  
 ‘ this, let the Saltpeter-Earth that’s boil’d out, be flung  
 ‘ again into the Pit, with the Lee which did not shoot to  
 ‘ Saltpeter, and let it lay one or two Years, and pour some-  
 ‘ times some Urin on it, or for Want of that, common Wa-  
 ‘ ter; for that Earth will yield Saltpeter again, tho’ not  
 ‘ so much as it did the first time.

‘ But if you have no need for Money, then let that Treas-  
 ‘ ure lay, and as often as it is dry, moisten it, to make  
 ‘ the Saltpeter grow and increase more and more; and thus  
 ‘ you gather a hidden Treasure, and hardly know which  
 ‘ way you come by it: If you do not want it, your Children  
 ‘ will find it; Thieves will not rob you thereof, nor will  
 ‘ the Plunderers in time of War carry it along with them.  
 ‘ When you have fill’d one Pit, you may make another next  
 ‘ to it, to prevent the above specified Things from being  
 ‘ flung away in Waste; and if in every Village there were  
 ‘ but one that would do this, the Produce in a small Country  
 ‘ would amount to a surprizing Quantity in a Year, for the  
 ‘ Service of the Publick; and there would never be Want of  
 ‘ Saltpetre.

‘ As soon as the Saltpeter is ready, your Money is ready,  
 ‘ and Gold and Silver not far off. This mind, and be ad-  
 ‘ vised; you will surely grow once wise, and see how blind  
 ‘ you and your Equals have been: But praise God first, and  
 ‘ be serviceable to your Neighbour; for God has given it  
 ‘ me, I give it you, give also something to your Neighbour,  
 ‘ and we are all help’d”.

*How*

*How to cleanse Saltpeter.*

**P**UT the Saltpeter into a Pot or Crucible, set it on a good Coal Fire, till it is dissolv'd like Water. Then sling on one Pound, about the Bigness of a Nut, of coarse pulveriz'd Sulphur, and it will flame; when this with the Smoak is vanish'd, then pour the Saltpetre into an Iron flat Pan, and let it congeal, which it soon will do, and looses nothing; you may take an Earthen Dish for this use, and pour the melted Saltpetre out of the Iron Pan into it by slow Degrees, letting it settle to the Dish round about, for which end you may have one that keeps the Dish in due motion to receive the Saltpeter, beginning in the middle, and so let it spread in a circular Form. The Settlings in the Iron Pan will be of a reddish Hue and impure, which boil and take from it what is serviceable.

*A quick Cleansing of Saltpeter.*

**I**F one is in Haste to have a quantity of Saltpetre cleansed either for Aqua Fortis or any other Work, let him make a strong Lee, and dissolve the Saltpeter over a Fire in a Kettle; when all is dissolv'd, pour the Solution through a coarse Cloath into a Vessel; ; then rinsing the Kettle, boil it again so long till it is fit for shooting, then pour it into a Copper Pan, and the clear Saltpeter will shoot in Crystal, and the Salt remain in the Lee.

*Another Way to cleanse Saltpeter.*

**T**AKE Saltpeter, as much as you will, pour fresh Water to it as much as is requisite for its Solution, let it boil till all is dissolv'd, and a great Scum raised. Then have a Tub at hand, which has a Hole at Bottom, under this set another Tub; at the Bottom of the first Tub put clean wash'd Sand, about six Inches high, and over that a Linnen Cloath; upon this pour the warm Lee, and let it run off, and the Feces and common Salt will be kept back in the Cloath and Sand: When it has done running, pour it again into the Kettle, boil it, as much as is requisite to coagulate it; pour it out in Troughs or Copper Pans as before, and the Crystal will shoot in two or three Days much finer and cleaner; these gather, the remaining Lee put again to boil; the oftner this is repeated, the cleaner will be the Saltpeter.

*Another**How*



*Another Way to cleanse Saltpetre from all hurtful Matters.*

**T**AKE two Pound of Quick-Lime, one Pound of Verdegrease, one Pound of Roman Vitriol, one Pound of Sal Armoniac, beat it all to Powder, and mix and put it together; then put it into a wooden Vessel, pour on it as much Vinegar as is sufficient to make a Solution, or for want of Vinegar you may use clear Water, let it turn into Lee and settle for three Days; then put the Saltpetre into the Copper, and as much of the foresaid Lee as will cover it; boil it over a slow Fire, till it is half consum'd, what remains take out of the Copper, and put it in another Vessel, the Forces at the bottom sling away; let the Saltpetre Lee cool, and proceed as has been directed before.

*Another Method to purge Saltpetre after the first Cleansing, by Thurnifer.*

**P**UT into a clean Tub sifted Beech-Ashes, pour fresh Water upon it, stir it well with a stirring Stick together, and let it settle; then pour the first Water off, and pour fresh Water to the settled Ashes; stir this as before, let it settle, and repeat this so long and often till the Lee is smooth and strong enough, which you may learn by palating a little of it on your Tongue.

Then take the once cleansed Saltpetre, put it into a clean Copper, pour on it the Ash Lee about a Hand high above the Saltpetre, and measure the Depth with any Stick or Rod to the Bottom; then make a Fire underneath, and boil it; when it boils, take the Scum off with a scumming Ladle, but let the Lee be well drain'd from it, to prevent Waste; and when it has boil'd so much away as the Lee was above the Saltpetre, which you may inspect into by your Rod or Measure, then drop from your Ladle a few drops upon live Coals, and if it glistens and burns a blue Flame, it has boil'd enough; but if you don't see this, then it is not boil'd enough, and you must keep on boiling it till it gives a blue Fire. Then take a clean Vessel, that's not too deep nor too shallow, place it where it may be cool, spread over it a double or treble Cloath that's clean, through this pour your boil'd Saltpetre into the Vessel; then cut some Splinters of Fir  
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about a Span long, lay them cross one another in the Vessel, and the Saltpetre will shoot to them like Ifficles; this Saltpetre changes its Name, and is call'd Saliter, or refin'd Saltpetre.

*To try Saltpetre whether it is good.*

**L**AY a little Saltpetre upon an even clear Table, light it with a Coal, if it crackles like common Salt when put into the Fire, it is a Sign that it has much common Salt; if it gives a fat and thick Scum, it shews that it is full of Greasiness; when the Saltpetre is burn'd, and there remain Fæces, it is a Sign that it contains much Earth; but when it gives a quick Flame, and many sparks, and the Table remains without any Fæces, and burns like a clean Coal without Scum or cracking, it is clear. Also, if after the second boiling there is but four Pound out of a hundred diminish'd, it is a Sign the Saltpetre is good.





## PART VIII.

### Several Choice CURIOSITIES.

#### I.

#### *Of the Regeneration of Plants.*



**T**AKE of any Plant the Seed, which has been gathered in a bright and clear Day, to the Quantity of four Pound. This beat in a Glafs Mortar, and put it in a Phial, close it well up, and set it by in a warm Place. When this is done, choose a fine Evening in the Month of *May*, and prepare to catch the Dew you see is likely to fall that Night. Take the Seed out of the Phial, put it in a large earthen Dish, place that in a Garden or Field in the open Air; and in order to catch more Dew than what will fall into the Dish, you may hang some very clean Linnen Cloaths about the Gardens or Fields, and gather the Dew to the Quantity of two Gallons, by wringing it out of the Linnen; put all your Dew in a clean Glafs, and the Seed which has been moistened therewith put, before the Sun rises, again into the Phial; close it well up, to keep it from evaporating, and put it to its former Place: You filter gathered Dew thro' a whited-brown Paper, and then distill it so often till you see it free from all earthly Particles; the Settling calcine, and you will have a fine Salt, which is presently dissolv'd in the distill'd Dew: Of this with Salt pregnated Dew, pour so much in the Phial upon the Grain, as will cover it three Fingers high a-top. Then seal it with beaten Glafs and Borax, put it into a warm damp Place, or in Horse-Dung for a Month; and after the Expiration thereof, you will, by examining the Phial, find the Seed change into a Jelly, and the Spirit thereof swim a-top like

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like a Fleece of several Colours. Between the Fleece and the clayish Earth you will see the Dew, which is pregnated by the Seed, and is united to its Nature, resemble a green Grass: These Phials well seal'd, hang throughout the whole Summer in the Day-time in the Sun, and at Night in the Moon; but if it should rain, then set it in a warm and dry Place, till the Heavens are clear again, and then put it again in the open Air. It sometimes happens that this Work is accomplish'd in two Months time, and sometimes it will require a whole Year, according to the Weather.

The Marks or Signs by which one may know that it is come to its Perfection, are these: The slimy Water at Bottom swel- leth up; the Spirit, together with the Fleece, daily diminishes, and altogether grows thick and troubled; then you see in the Glass, when the Sun Beams reflect upon, innumerable delicate Atoms arising, yet very tender and without Colour, much like Cobwebs, and like Shades of the growing Plant, but fall suddenly, as soon as the Sun withdraws its Beams from it. At last the slimy nasty Matter at Bottom changes into a whitish blue Ash, out of which by Degrees shoot out Stalks, that branch themselves out in Plants and Blossoms, in the Nature of the Seed used for this Experiment; and this Phœnomen is observ'd only in warm Weather, but in cold Weather it is invisible, so long till it comes to be warm again. It will retain this Quality as long as the Bottle is kept whole.

*A fine Curiosity to make Metals visibly to grow.*

**C**ALCINE fine white and transparent Pebble-Stones, by first glowing them red hot, and quenching them in Water; this repeat till you have reduc'd them to a fine Powder. Of this take one Part, and two Parts of Tartar, which has been reduced by Saltpetre; put it in a clean Crucible in Fusion; when cold bear it fine, strew it upon a Glass Table or Marmor, and let it in a moist Place flow to an Oil, or rather Liquid.

Of this Liquid take about four, five, or six Ounces, put it in a white Phial, add to it a Dram and a half of metalline Calx, which has been dissolv'd in Aqua Fortis; then let it to the Consistence of the Calx evaporate; let this stand, and when cold, you will see the Metal grow, and branch out in Twigs of different Colours, according to the Calx you have put in.



*N. B.* It is to be observ'd, that the Cause of this Growth is the volatile Acid meeting with a fix'd Alkali; we may conclude this from the following Experiment: Take Quick Lime and common Salt, calcine this together to an Alkali, fling it on barren Ground, and it will make it fertile, and cause Vegetables to grow and thrive thereon, by contracting the Alkali, the Acid, the Air, and the volatile Salt.

You dissolve Iron in Spiritus Salis, and abstract the Spirit from it till it is dry, and there remains a fiery Red Mass; of this break about the Bigness of a Pea, put it into the before describ'd Liquid in a Phial, and in few Hours you will see a Tree in full Growth, of a dark brown Colour. Gold for such Experiments is dissolv'd in Aqua Regis; the other Metals, as Silver, Copper, Tin and Lead, are reduc'd by Aqua Fortis. The Gold will produce a Growth of a yellow Colour; Silver a Blue; Copper a Green; Tin and Lead a white Colour.

This affords a fine Speculation, particularly to those who delight in the Study of Mineral Productions.

*Crescentia Lunæ, or the Philosophical Lunar Tree.*

**T**HE Nature of the Growth and Increase of Silver Oar may visibly be demonstrated by the following Representation:

Take clean settled Aqua Fortis six Ounces, dissolve therein two or three Ounces of fine corned or beaten Silver, pour after this three times as much clean Rain-Water on; in this Solution you put to one Ounce of Silver, three or four Ounces of purified Mercury, let it stand undisturb'd in the cold, and you will plain and distinctly see, how by the Help of the Spirit of Tartar or Nitre in the Aqua Fortis, the Silver and Mercury work conjunctive, and form Varieties of pleasant Vegetables, Prospects of Hills, Rocks and Vallies: This Manner is supposed to be the Beginning of the Growth of Metal Oar in the Mines.

*Of Mines, and how to discover them.*

**H**UMAN Life would certainly have enjoy'd more Innocence and Satisfaction, were it not for the Riches and Lustre which Nature dazzles their Eyes with, and makes them indefatigable Searchers, into the innermost Recesses of the Earth, to her hidden Treasure.

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Those subterraneous Treasures, are discovered several Ways :

1. When after great Floods of Rain the Current in the several Channels washes and discovers the Veins of Oar which Nature had concealed with Earth, as happen'd formerly at *Freyburg* in *Saxony*.

2. Sometimes Metal Oars are discovered after a great Storm, when thereby Trees are tore up by the Roots, that grew on the Surface of Gold or Silver Veins.

3. *Justinus* relates, that *Galicia* was very rich of Copper and Lead, and *Baramaus* of Gold, and that it has often happened that Husbandmen in plowing their Land, have plowed up Pieces of Gold Oar, and thereby discovered the Mines thereof. Nay, it frequently happens that Mines are discovered by digging of Wells.

4. *Diodorus Sicculus* mentions, that through the Fire the Shepherds made in the Woods in *Spain*, the like Mines were discovered.

5. It is reported for certain, that the Lead Mines at *Goss-lar*, a City in Lower *Saxony*, were first discovered by a Horse beating his Hoof against a Lead Oar, and the like has happen'd with Swine, in routing up the Ground, when they search'd for Acorns.

But all these are Accidences: It is therefore better to have certain Rules to direct one to the Discovery of such Mines; which indeed are best learn'd by long Experience; however, those that have been observ'd, are the following:

1. When on the Surface of the Earth, Pieces of Oar of ripe Metal are found, it is a certain Sign that Veins of Oar are there. By this was the rich Mine at *Kuttenburg* in *Bohemia* discover'd; a Friar walking there for Pleasure in a Wood, found a little Twig of Silver, which sprung out of the Ground; he was so careful as to cover the Place with his Cloak, and carry the good News to his Convent.

2. When a white Frost is all over the Country, there will be none over the mineral Veins, because they send up such Drought and warm Fumes as hinders the Frost, and for this Reason Snow sooner melts in those Places than in others.

3. It is a certain Sign that Minerals are found in such Places where the Shrubs and Trees are observ'd to fade by the latter End of the Spring, become spotty, and of a reddish Colour.

4. A Hill, the Foot whereof towards the North, and the Top towards the West, holds for the most part Silver Oar; the Silver inclining from West to North.

5. By carefully examining into the Colour of the Earth, one may conjecture whether there are mineral Oars: And the Colour of the mineral Earth will shew what Metal it carries; a Greenish Earth denotes Copper; Black gives good Hope to Gold and Silver; but the Gray and White for none but Iron or Lead.

6. Dry, barren, and as it were, burn'd up Hills, contain all some Metal, because all the hurtful Vapours that fume out of the mineral Veins, dry up the Plants.

7. When Stones or Earth are heavier then ordinary, it is a Sign of mineral Veins.

8. The Springs at the Bottom of Hills often discover Mines, either by their Colour, Smell or Taste, or by carrying some small metallick Substance, whereby one may perceive that there are mineral Veins.

9. Some, but not many Plants and Trees which have a Sympathy with Metals, grow commonly over Oar Mines, and give thereby notice for the Discovery of them; as Juniper, wild Figs, and most Plants of a prickly Growth. When Hills are always covered with Vapours and Smoak, it is a Sign that there are Metal Veins.

These are the Directions which are followed by such as are in Search after mineral Oar, as they are set down by *Agricola*, *Cardano*, *Glauber*, and *Kircher*. This last Author proceeds thus: "Lastly we must let it rest here, that all the Knowledge  
" in Discovery of Mines here mentioned, are only founded on  
" weak Foundations, and that there is none of those supposed  
" Marks, whereby one can be sure and certain; after you have  
" discovered the Place that contains Oar, neither what Quan-  
" tity, nor what Kind it holds, for those Signs will direct as  
" well to Sulpher, Antimony, Salt, Mercury, Lead, Iron,  
" Copper, Tin, as to Silver and Gold. But by Virtue of the  
" Winchel-Rod, one may with Confidence distinguish the one  
" from the other, and know what Kind of Oar the Mines con-  
" tain; for by holding in each Hand a Piece of Gold, the  
" Rod who thereby contracts the Atoms of the Gold, will  
" beat or move to no other Metal; with Silver it will be the  
" same. As those who profess themselves Possessors of that  
" Art, affirm".

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*How to search for, and to find Springs.*

**VITRUVIUS**, in his Book of Architecture, takes Notice of the following Experiments, used in his Time to discover Springs; *viz.* 1. If one will certainly know where Water is to be found, he should a little before Sun-rising lie flat upon his Belly, and rest his Chin upon the Ground, looking round about him; and if he sees at any Place a rising Vapour or Fog, in such Place he may be assur'd of Water. 2. In looking for Springs, one ought well to examine the Condition of the Earth, because in certain Places you have several Sorts: The Water that's found in Chalky Grounds, is neither plenty, nor of a good Taste; that which is discovered under a light Sand, after you have bestow'd much Labour in digging deep enough for it, will be very little, and thereby slimy and disagreeable; black Earth contains the best Water, because the Rain, which falls in the Winter Season, soaks best into such Earth, and (on account of its Closeness) preserves Water better than spongy Earth. Springs that are in dark Gravel, and those not far from Rivers, are also very good, tho' they afford no great Plenty; but those in coarse Gravel, Pebble, or other Stone are more certain, and the Water very good. Springs in red Sand are also good and strong, because the Water is not suck'd up like in Stone Quarries. Those at the Bottom of Hills, between Rocks and Stones, are the best, freshest, and most wholesome. Springs in Vallies are black, heavy, faint, and disagreeable, except they have their Source at some Distance under the Earth, or run through some shady Grove of Trees whereby they are made agreeable and pleasant; as is observ'd by such as spring out in the Vallies near Hills.

Besides the fore-mentioned Methods, there are others whereby one may conjecture the proper Place to dig for Springs; namely, where-ever are seen (growing by themselves) small Rushes, Willows, and such Plants which thrive no where else than in watery Places, it is a Sign there is Water underneath them; but this is only to be observ'd in Places that are free from Pools, otherways Rain-Water may gather and occasion the Growth of such Plants, without the help of any Springs. But if one cannot come at these Trials, the following may be ventured upon, *viz.* Dig a Hole, three Foot wide, and three or four Foot deep, after Sun-set; then take a Copper or Leaden Bason, Dish, Cup, or what you will, anoint the Inside with Oil, and set it on

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the Bottom of the Hole, with the Inside downwards; then fill the Hole with Leaves of Trees, and over them Earth: The next Day when you take up your Bafon, and you find Drops of Water hang the Inside thereof, it is a fure Sign, there is Water in that Place.

Or, put an earthen Pan that's not glaz'd in fuch a Hole, and in the forefaid Manner; if there is Water in that Place, the Pan will be wet and damp. Or, if you fling Wool in fuch a Hole, and you can the next Morning wring Water out of it, it is a fure Sign of a plentiful Spring.

When a Lamp, light with a little Oil is put in fuch a Place, and neither the Wick nor the Oil confum'd the next Day, or the Lamp is damp, it is a Sign of a Spring, and that the Lamp has been fed with the Damps thereof.

Another Tryal is, by making a Fire in fuch a Place, and when it is well heated, it will caufe a thick Vapour or Smoak, which is a Sign of Water.

*Cassiodorus* will have it, that where fubtile Vapours or Mifts raife in perpendicular Pillars, in fuch Places one may be fure of Springs, which lay as deep under Ground as the Pillars are high. The fame Author recommends alfo for a fure Sign that which the Well-Diggers have, who when after Sun-rife they fee a Swarm of Gnats as it were, in a Cloud, they conclude that underneath them the Earth contains Springs.

*Pater John Francois*, a Jefuit, is of Opinion, that Springs are beft difcovered by boring, whereby the different Earths under the Surface may be brought up, and examined whether they have any Sign of Water, or not: He adds, that fuch Gimlets might be made to bore through Quarries of Stone, and in cafe the Gimlet fhould not be long enough, to dig four or five Foot deep, and help it further that Way.

*Pater Kircher* gives us another Method whereby to difcover Springs, or fubterraneous Water-Courfes, which he himfelf had tried with great Succefs, it being very eafy put in Practice: Make a Ballance of Wood, in the Shape of the Needle of a Compafs; each Point thereof muft be made of different Sorts of Wood, one end too muft be of fuch a kind, that will eafily attract wet, as Elder, or the like. This Hand is ballanc'd between an Angle or Axis, or is hang'd on a Packthread, in a Place where Water is fuppofed to be. If there really is Water, the Hand will foon loofe the Balance, and the Point of Elder

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incline towards the Ground. This Trial is (says he) to be made in the Morning early, before the Sun has dispersed the Vapours of the Earth.

These are the best of the common Methods, which I know, to discover Water Springs; but how curious and ingenious however they are, the Searcher is often deceiv'd by them. *Pater Kircher's* Method, indeed, is the easiest; but his Project is not so much for discovering of Springs, as to determine whether there is any Water in that Place.

But the *Winchel-Rod*, is the most wonderful Invention for that Purpose, that has yet been discovered and the Operation thereof is surprising; for by Virtue of a Hazel-Rod or Stick, not only the Springs, but also the Depth to them is easily discovered to a great Nicety. *Pater de Charles*, who made himself famous on Account of writing a Book intitled *Mundus Subterraneus*, after he has enumerated several Ways of discovering Springs, concludes thus: "There is another Method to search for Water, which is the most wonderful of all; but every one has not the Capacity of putting it in Practice. The whole Mystery consists in this; a fork'd Twig is cut off a Hazel or Mulberry-Tree, and he who searches carries it loose in his Hand, but as soon as he goes over a Spring, he will observe the Stick to turn in his Hand, and incline to the Place where the Spring is". A large Account of this and the foregoing Matter, is given by the Author of the *Accurate Description of the Winchel-Rod*, written in the German Language.

#### *A Camera Obscura.*

CHOOSE for the Trial of this an Apartment, out of which you may have a Prospect into fine Garden-Walks or other Places of Resort; contrive a Hole, either through the Wall, or else in a Board fix'd in the Window, in which fix a round Glass out of a pair of Spectacles, and shut all the rest of the Light out of the Room, but what enters through that Glass; then at a convenient distance fix a Sheet of White Paper or a White Cloath, and you will with delight see the Objects without, presented thereon in their lively Colours, especially in a bright Sun-shiny Day, you will see the Birds in the Air flying, Ships (if you have such a Prospect) sailing, People walking, Coaches riding, and every Thing else appear in such Beauty and Order, as will draw your Admira-

tion to consider how the Colours are displac'd in their proper Shades and Altitude; and how when two different Colours meet, the one is not changed by the conjunction of the other, and what other Speculations it may afford you, both useful and entertaining.

It is to be observ'd, that all the Images which fall through the Glas upon the Paper, Cloath or white Wall, appear upside down, and to have them represented right, the following Experiments have been approved of; the first is, by fixing another Glas of a larger circumference at the outside of the Apartment, before r'other Glas is fix'd in; this may be done when the two Glasses are fix'd in a proper Frame or Tube made of Wood or Tin, for then they easily may be fix'd into a Hole made for that Purpose in the Window Shutter or Wall, but the Objects will not appear so plain and clear as through a single Glas.

We will here present the Curious with a Model and Description of a moveable *Camera obscura*, whereby he may draw Things, relating either to Orthography or Ichnography, to the greatest Perfection. The Machine is prepared with as little Trouble as Expence, in the following Manner.

Make a Cubical or an even-sided Frame, and close all the Sides round with thick Paste Board; on the opposite Sides make a little Hole, in each whereof fix a Glas through which the Images of the Prospect about may enter; fix a White Paper opposite the Glas at a proper Distance, and having a little Hole made near the Glas, you may through that see the Objects in a beautiful Manner on the Paper, which enter through the Glasses.

*To Illuminate an Apartment with various beautiful Colours.*

**P**UT three or four Prysms, or Glasses pinn'd in a Triangular Form, together, of a Window, to make it portable, as you see in the Figure A, B; let the Prysms be so fix'd Corner to Corner, that on one Side they may make a Flat, and on the other a Trigonic Face, as in the Figure; place this Frame thus finished before a Window towards the Sun, so that the flat Side be towards it, and if there be any more Windows in the Apartment, let them be closed up. As soon as the Beams of the Sun shine through these Trigonic Glasses, your Apartment will appear like

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like a Paradise, in the greatest Beauty and of various Colours. If you catch these Beams in a concave Glass, you see the colours change quite different from what they were before; and if you look through those Glasses into the Street, you see every Thing in different Colours, so that you will be in a Sort of Surprise and Admiration.

*Diana, or the Philosophical Tree.*

**T**HIS Operation is a Mixture of Silver, Mercury, and Spirit of Nitre, crystallized together in the Shape and Form of a Tree.

Take one Ounce of Silver, and dissolve it in two or three Ounces of Spirit of Nitre; this Solution put into a Matrafs or Glass Phial, into which you have put 18 or 20 Ounces of Water, and two Ounces of Quicksilver. Let your Phial be fill'd up to the Neck, and place it in some convenient Place where Nobody can meddle with it, for 40 Days together, in which Time you will see a Tree spread forth its Branches, with little Balls at the Ends thereof, representing the Fruit.

*Another Manner to make a Tree of Diana.*

**D**ISSOLVE an Ounce of fine Silver in three Ounces of Aqua Fortis, in a Phial or small Matrafs; evaporate about half that Moisture in a warm Sand, by a gentle Fire; then add to it three Ounces of good distill'd Vinegar, heat it a little, and stir it about; then put your Matrafs in a safe Place, where it may rest for a Month, and you will see a Tree growing to the very Superficies of the Liqueur, and resemble in its Branches a Fir-Tree,







## Curious Secrets for preserving Things from CORRUPTION.

*To preserve Things from Corruption in Spirit of Wine.*

**T**HIS is done with the most subtil rectified Spirit of Wine, camphariz'd; wherein many Sorts of Animals, Birds, Fish, Insects, Reptiles, &c. may be kept many Years from Decay or Corruption. *Porta* mentions to have seen a Fish at *Rome* thus preserv'd for above 20 Years, which was as fresh as if alive; likewise at *Florence*, where he saw one that had been preserv'd above 40 Years. The Glasses, wherein they were kept, were Hermetically sealed, to keep the least Air from coming to it.

*The Preparation of the Spirit or Oil of Salt, whereby Things may be kept from Corruption, and is a great Restorer and Preserver of Health.*

**T**AKE Sea Salt, as much as you will, put it in a Pan or Crucible cover'd, over a good Coal Fire, and when it has done crackling, take it off, put it in a damp Place, till it is dissolv'd; filter it often through a Paper, till it is thorough clear and fine. Then let it digest in Horse-Dung, for about two Months, changing the Dung often for fresh, in order to keep it continually warm. Then distil it over some Sand, and you will have in your Receiver a Salt Oil, with a watery Phlegm; distil this gently in a *Baln.* and the Oil will keep back, but the watery Substance be carried off; whatever is put into this Oil, will keep from Corruption without changing, for Hundreds of Years. This is the Salt Spirit which by *Paracelsus* is call'd *Vividitas Salis*, and has incomparable Virtues, as well to restore Men to Health and Vigour, as also to preserve them from most Distempers; four or six drops taken in Wormwood Water, is good for the Dropsy, Convulsions, and the yellow Jaundice; three or four drops taken in Harts-horn-Water is good for all

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all Sorts of Agues; for Worms, it is taken in Brandy; three Drops taken in *Carcit* or *Cordobenedictine* Water, is good for the Stoppage of Urin. It is a fine Remedy for all Sorts of Sprains and Contractions of Nerves; it heals Bruises and Swellings, when mix'd with other Ointments, and the griev'd Parts are anointed. When mix'd therewith with Oil of Turpentine or Wax, or Camomile, it will assuage the Gout. This Oil or Spirit of Salt, if it is well rectified, is a Solution for all Sorts of Metals and Stones, and a Key to many hidden Mysteries.

But if this Preservative is too costly to keep things from Corruption, you may prepare a Sea-Water with a small Expence, which will keep Things for many Years; and this you do in the following Manner:

After you have searced your Sea-Salt, dissolve it in distill'd Rain-Water, and make thereof a Lee which will bear an Egg.

Or, when the Salt is searced, put it into a damp Place, and when it is dissolv'd, filter it through a Paper so long till it is clear and fine. This you may use to preserve Things from Corruption, by stilling it, and pouring it over the Thing to be preserved.

*A Regeneration of Coral.*

**T**AKE Verdegrease three Pound; live Sulphur one Pound; clear Sand four Pound, pulverise and mix it; then still it in a Retort on Sand, first with a slow Fire, but augmenting it by degrees, and it will produce a Spirit, which has a sweetish four Flavour.

If this Spirit is pour'd upon powdered Coral, or Harts-Horn Filings, and by a gentle Warmth is quite dry'd up, then put it into a Phial with some distill'd Rain-Water, and set it in a warm Place well clos'd up, the Coral or Harts-Horn will shoot and grow so natural that it will be delightful to behold it.

*To prepare a Phosphorus.*

**T**AKE Urin, as much as you please, put it into a Tub or Kettle, let it stand for three Weeks or a Month together and putrify, then boil away the humidity till the remainings become a black and tough Matter. Of this take

one Pound, Oil of Tartar Fœtid, or the stinking Oil of Harts-Horn, or for want of that, green Wax, mix it well with the Matter, put it in a Retort, set it on a strong Fire of a Reverberatory Furnace, fit to it a large Receiver, lute the Juncſures, give firſt a gentle, and laſtly for four Hours the moſt fierceſt Heat you can; and you will find in the Receiver in the firſt Settlement the Volatile Salt, then ſome Oil, and after that the Phosphorus, who in the Receiver has ſublimated of a yellowiſh Colour; let the firſt ſettlement ſtay over Night and grow cold, then take and waſh with the Liquid that is at the bottom, all the Phosphorus and Oil, mix it well together, put it into a Matraſs, ſtill it out of a Sand Coppel, and you will find in the firſt Settlement Grains of Phosphorus, which, whiſt warm, preſs into little Sticks, and preſerve them in a little Phial as the former.

*Another ſuch luminary Matter.*

**T**AKE what by moſt Apothecaries is known by the Name of Land-Emerald, as much as you will, beat it fine with Water on a Stone; temper it with Gum or Honey Water, and write or paint therewith upon a poliſh'd Copper or Iron Plate, whatever you will, and let it dry; then lay it upon a Charcoal Fire, or ſet it before the ſame, and in a little while it will light, ſo that when you bring it into a dark Room, or put the Candles out, the Company who are ignorant of what is done, will be ſurprized at ſo ſudden and ſtrange Appearance.

*To prepare a Room or Cloſet in ſuch a Manner that any one entering with a lighted Candle, will think himſelf ſurrounded with Fire.*

**T**AKE a pretty large Quantity of Brandy, and put it in a Bowl; ſet it on a ſlow Coal Fire, to receive heat enough to boil gently up; into the Brandy ſling ſome Camphir, cut in little Bits, which will ſoon diſſolve, and when all is diſſolv'd, cloſe both Windows and Door, and let the Brandy boil and evaporate; by this the whole Room will be fill'd with ſubtle Spirits, which, as ſoon as a Candle is brought in, will be lighted, and ſeem as if all was a Fire. If ſome Perfume is diſſolv'd in the Brandy, the Flame will be attended with a fine Smell.

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*To prepare a Luminary Stone.*

**T**AKE good rectified Spirit of Nitre, fling Quick-Lime and Chalk into it, till the said Spirit can't dissolve no more, and ceases to ebulate; filter the Solution, put it into a Retort, and still the Spirit of Nitre from it again; what remains in the Retort, place in the Air, and let it dissolve; then put it again in the Retort, draw off the Moisture till it is dry; set it again in the Air and let it dissolve; then pour it into Assay-Cups, put them into a Cucurbit, and distill all the Moisture from it; the Remains put under a Muffle to harden. Then hold it in the Light of Day, of the Moon, or the Light of a Candle, and it will contract that Light, so as to give it again when put into a dark Place.

*The Preparation of a Phosphorus.*

**T**AKE an earthen Plate or Dish, which is not glaz'd, about half an Inch thick; and make a Sort of Paste of Spirit of Nitre and pulverized Chalk, well stirred together; of this take the bigness of a Shilling, put it into the Plate, and set it in the Fire under a Muffle (where it will ebulate much) to dry; when dry, take it out, let it cool, and mix it up with Spirit of Nitre: This do six or eight Times, and it is ready: After it is cold, hold it a little while against a Candle, and shewing it in a dark Place, you will be surpris'd at the Light it gives.

*How to prepare Thunder Powder.*

**T**HIS is done with three Ingredients, namely, three Parts Saltpeter, two Parts of Sal Tartar, and one Part of Sulpher; these are pounded and mixt together: if you take about 60 Grains in a Spoon and warm it over a Candle or other Fire, it will give a Report, like a Cannon fired off, and thus the Flashing will beat downwards: If you make use of a Copper Spoon or Cup, you will after the Report find a Hole at Bottom; but when light it at Top, it will burn away like Lightning.



*To represent a Philosophical Tree in a Glass.*

**T**AKE of the finest Silver one Ounce, Aqua Fortis and Mercury of each four Ounces; in this dissolve your Silver in a Phial, and after you have put over it a Pint of Water, close your Phial, and you will see a fine Tree spring forth in Branches, which will encrease and grow thicker every Day.

*To represent the four Elements in a Glass Phial.*

**F**IRST tincture in a Phial, good Spirit of Wine with *Terra Solis*, to represent the Air; then take well rectified Oil of Turpentine, this you tincture with Saffron, and red Ox-Tongue-Root for Fire; Oil of Tartar, to which you add a little Ultramarine, to give it the Colour of the Sea or Water; and for to represent the Earth, take a little Smalt. This you may shake together, and after it has stood a little, every Thing will take its Place again, for the three Liquids will never keep or unite together.

*Another.*

**H**AVE a Glass made in the Shape of an Egg, fill the fourth Part thereof with clean Smalt, or common Antimony, (*a*) to represent the Earth; for Water (*b*) take Spirit of Tartar; for the Air (*c*) Spirit of Wine three times rectified, and Oil of Benjamin, which in Colour and Brightness may represent the Fire; (*d*) the Cover of the Glass may be ornamented with a Flame, or what you please.

A Florence Flask will answer the same Purpose, made with a Foot to it as you see in the Figure.

*An Elementary World in a Phial.*

**T**AKE Black Glass or Enamel, beat it to a midling Gravel Size; this, for representing the Earth, will settle at the Bottom; for the Water you may use calcin'd Tartar, or sandy Ashes, which you first moisten, and what thereof dissolves, pour the clearest into the Phial, and tincture it with a little Ultramarine, to give it the Sea Colour; for the Air use Aqua Vitæ, the best you can get, which, when tinctured with

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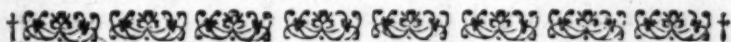
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with a little Turnsole, gives a Sky Colour; to represent the Fire, take Linseed or Oil of Turpentine, and prepare the latter thus: Distil Turpentine in *Baln. Mar.* the Water and Oil will raise transparently together, but the Oil will afterwards swim a-top, which take, after you have coloured it with Ox-Tongue and Saffron. All these Matters differ both in Weight and Quality, for if you shake them together, you indeed observe for a little while a Chaos full of Confusion and Disorder, but as soon you put the Phial down, every Matter takes its respective Place in the same Order as before.

*To ornament a Room with a continual moving Picture.*

**P**LACE a large Picture against the Wainscot, in a Summer-House, or any other Room where the Wind may be convey'd to the Back of the Picture; bore little Holes through the Wainscot, to correspond with some Past-Board Wheels that are at the Back of the Picture; the Wind which blows on them through the little Holes, will put them in Motion, and having on the right Side of the Picture such Things painted and fix'd to the Past-Board Wheel on one Spindle, they will have an equal Motion with them: And there may be several Things represented in a Picture, and their Motion made agreeable; as for Example, a Mangrinding of Knives, a Woman at her Spining-Wheel, a Wind- or Water-Mill, and several other Fancies, a Man's Curiosity will direct him to.



## Of the Regeneration of ANIMALS.

### *Of Craw-Fish.*

**I**T is to be observed that if you will succeed in this Experiment, you must choose the full Moon, and if possible, when in a watery Sign; then take a parcel of live Craw-Fish, which are catch'd in Rivulets and Brooks, divide them in two Parcels; one Parcel put into an Earthen Pan

Pan that's not glaz'd, lute it well, and put it into a Furnace to calcine for seven or eight Hours, in a strong Fire : After they are well calcined, beat them in a Marble Mortar to Powder; then take the other Parcel, and boil them in the same Water they were catch'd in, pour off the Water in another Vessel, about half a Paleful, and fling into it about half a Handful of the calcined *Craw-Fish*, stir it well together with a Stick, then let it settle, and remain still, and in a few Days you will observe in the Water a great Number of small Atoms in motion. When you see them grow up to the bigness of a small Button, you must feed them with Beef Blood, flinging thereof by little and little into the Water, which will cause them to thrive, and to grow to their natural bigness; but you must observe, that before you put them in the Vessel with Water, you lay Sand at the bottom about an Inch thick.

*Petro Borello*, in the 34th Paragraph of his *Physical History*, says : If one takes the Ashes of *Craw-Fish*, and lays them in a damp Place or in an Earthen Pan, moistened with a little Water, and lets it stand, in less than 20 Days will be seen innumerable little Worms; and if after this you sprinkle Beef Blood upon it, they will by Degrees turn into *Craw-Fish*.

The *Sieur Pegarius*, when he treats upon this Subject, says: " As to the Generation of Animals, a Friend of mine did see the Figures and Shapes of *Craw-Fish*, in a Lee he made of calcined ones; but what is more surprising, out of such a Salt, not only the Resemblance of such Creatures is produced, but also the very Animal itself, alive and in its natural Form and Shape; as *D. de Chambulan* and others have experienced, by flinging the Powder of calcined *Craw-Fish* in standing Water; the like may be done with the Ashes of Toads. *Rochas*, in his *Art of Nature* writes, that out of a rotten Duck have grown several Toads, because she had fed upon these Creatures; and that the Carcass of an Owl which has fed upon Jacks, will bring forth great Numbers of that Fish after it is rotten; and if the said Owl has fed upon Carps, the rotten Carcass will produce Carp : And from hence it is, that when a Fish-Pond is quite dried up, and Water is again let in, it will abound in a little Time with Fish of such Sort as never were in before".

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## Of Eels.

**K**IRCHER in the first Part of his subterraneous World speaks thus of Eels.

Eels grow without a Sperm, or Seed, out of the Skin they throw off yearly, and corrupts; or of what sticks to the Stone against which they rub; the Truth of this may be easily experienced, by chopping an Eel in little Pieces, and flinging them in a muddy Pond, for in a Month's Time there will appear a Brood of small Eels.

Another Generation of Eels is perform'd thus; take two Spattles of Turff, let 'em lay that the Dew may fall upon 'em, then lay them Grass to Grass, and put them into a Pond or Ditch, so that the Water may play upon, and you will see first little Worms come from between, which in time will grow up to Eels.

According to *Aristotle*, there is neither Male nor Female among Eels, neither do they copulate, nor do they spawn, and there is never an Eel found with either a soft or hard Roe; from all which it may be conjectur'd, that when a slimy Water has been quite drain'd off, and the Slime been taken out, there has still been a Generation of Eels when fresh Water has been let in again; for in a dry Soil they don't generate, nor in the Sea that is always full of Water, because they have their Growth and Nourishment of the Rain.

They are also generated out of other corruptible Things, and we have seen, when a dead Horse has been flung into the Water, a vast Number of Eels have been perceived about the Carcase; and it is thought they come forth from other dead Carcases also. *Aristotle* says, they have their first Origin, in the inner Recesses of the Earth, where some of them break out into the Sea, and others in Rivers and Ponds.

That Vegetables produce all Sorts of Insects, and in particular Flies, we find in *Aldrovandro's* Third Book of Reptiles, where Chap. 16. he says thus: "As I will not deny that out of the most putrified Matters, even out of Carrion, grow Flies, I do believe that most of them have their Origin from Vegetables, as we have Examples of our own Experience; for a few Years ago, in a Winter Season, when for Want of other green Plants I pounded  
brown-



“ brown-Cabbage, and left them some time in my Room, I  
 “ found that Worms grew out of them, and that these Worms  
 “ turn’d into Lady-Birds; I gathered them into a Box,  
 “ and opening the Box some time after, a great Swarm of  
 “ little Flies flew out of it, which before had been Lady-  
 “ Birds.

Something of the same Kind did a good Friend and Cor-  
 respondent communicatè to me in a Letter, Dec. 28th 1671.  
 He writes thus: “ I once did read in an *Italian* Author,  
 “ that out of *Cheledonia* a Tincture could be prepar’d; this  
 “ did prompt me to make a stricter Search into the Nature  
 “ of that Herb; I took the whole Plant, chopt it fine, when  
 “ it was in full Juice, and put it into a Matraiss; then I luted  
 “ a Head upon it, thinking to distil it in *Baln. Mar.* but by some  
 “ accidental Hindrance, it remained almost a whole Summer  
 “ neglected in my Laboratory. Towards Autumn I found  
 “ that the whole Mass was liquified and full of Worms;  
 “ hence I could easily perceive what a fine Tincture I had  
 “ to expect, however, I let it stand the whole Winter; in the  
 “ Beginning of the Spring I found that the Worms were all  
 “ gone, and all was turned into a Black Powder; not long after  
 “ out of this Powder grew Gnats, in such Abundance, that  
 “ the whole Glass was full of them, who made a bustling Noise  
 “ and flew merrily about. I was in the Interim visited by an  
 “ Acquaintance, who spied the Glass with the Gnats as it  
 “ stood in the Window; we fell into a Discourse about them,  
 “ when he maintained that those Gnats would not bear  
 “ the open Air, but die as soon as it was convey’d to them.  
 “ I could hardly believe it, but to try the Experiment, I  
 “ pull’d the Stopple out of the Retort, and perceiv’d all  
 “ the Gnats dead in a Moment; after I open’d the Glass,  
 “ I found that most of the Powder was turn’d into Gnats,  
 “ except a little black Earth, which I tried, and found the  
 “ Taste very fiery, and produc’d, after it was light, a fix’d  
 “ Salt, which without Doubt may have its particular Virtue.

*Scaliger* says, that every Tree and Herb has its particular  
 Worm or Insect, and almost every small Vegetable its own  
 Fly. This a Virtuoso at *Rome* observ’d in his Garden,  
 and had them painted together with the Plant in their nat-  
 ural Colours; but we need not go so far as to *Rome*, we may  
 satisfy our Curiosity by perusing Mr. *Albini*’s Natural History  
 of English Insects.

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*Peganus's Relation of what happen'd with his Experiment  
in the Generation of Serpents.*

“**W**HEN Anno 1654, among other Authors I happen-  
 “ed to read *Theophrastus's* Book *de Verminibus*, where  
 “he in particular gives a surprising Account of our Ger-  
 “man Notters (Wipers) and having a Desire to try the Ex-  
 “periment of so great a Curiosity, order'd 25 Notters  
 “to be caught; I had them skinn'd, flung the Heads and  
 “Tails away, and saved the Heart and Liver for a particular  
 “Use, after I had made them into Powder; the Flesh and  
 “Bone I cut in little Pieces, put them into a glass Matraass,  
 “set over that another, and luted them close together.  
 “This I did in *July*, in my Laboratory at the Window,  
 “where the Sun only shined a few Hours upon it; I let  
 “it stand for two Months, and observed every Day whe-  
 “ther there appeared any Change in the Glass; after a few  
 “Weeks I saw some oily or greasy Drops hang to the Upper  
 “Glass, which were of a yellowish Colour; after I had  
 “look'd with great Attention upon these Drops for an Hour  
 “together, I observ'd issuing out of them snow white  
 “Worms very small, which crept downwards; and as these  
 “Worms encreased daily more and more, the first of them  
 “grew bigger, but the Matter at the Bottom of the Glass  
 “stood like a yellowish Oil with some watry Moisture;  
 “and the Settlement at Bottom appear'd of a black earthy  
 “Substance; after some Weeks the Number of Worms be-  
 “gan to decrease, the rest increased in Growth; at last they  
 “were all vanish'd to three or four, and they were about 2  
 “Fingers Length, and had an uncommon Brightness. In a  
 “few Weeks they were all lost, save one, which was  
 “pretty long, and had the resemblance of a Serpent, but of a  
 “snow white Colour, smooth and shining, without Scales,  
 “although there were very subtil black Lineaments across,  
 “which in the Glass I could not well distinguish; the Head  
 “differed also something from that of a Serpent, the rest  
 “of the Mass grew dry, and resembled a black close Earth:  
 “I was in one Respect rejoic'd to have the Happiness of  
 “seeing this Curiosity of Nature, in Regenerating a  
 “Serpent, but on the other Hand I was cautious how to  
 “bring the Creature out of the Glass, and how to proceed  
 further

" further therewith; at last Fear got the Upperhand of  
 " Reason, and in a Sort of Horror I took the Glais and  
 " flung it into an House of Office.

*Of the Generation of Silk-Worms out of Veal.*

**T**AKE about 10 or 12 Pound of Veal, all Meat without Bone, warm, and as soon as 'tis kill'd; this chop with a chopping Knife as fine as you can, afterwards put it in a new earthen Pot, thus: At the Bottom you make a Lay of Mulberry-Leaves, then a lay of Veal, and thus you proceed till your Pot is full; then cover the Top with Mulberry Leaves, and take an old Shirt, which has been well wore and sweated in by a labouring Man; this put at Top upon the Leaves, and then tye the Pot close with Leather. After this is done, set the Pot into a Cellar, which is not too cool, but something warm and damp, let it stand for three or four Weeks, till the Veal turns into Maggots, which happens sometimes sooner, sometimes later, according to the Nature of the Place you put it in. Of these Maggots take as many as you will, set them upon fresh Mulberry Leaves, which they will eat; change their Form to Silk-Worms; will soon content themselves with that Nutriment, and spin and generate like other Silk-Worms. I have produced them twice, not without the Admiration of the late Mr. *Sperling*, and yet I am of Opinion that this Generation is not of both, but only of one Kind; the same Opinion I have of Toads or Frogs, which are produced out of barren Earth.

The Time wherein Silk-Worms are to be raised, is in the Beginning of *July*, to the eighth of that Month, when the Process is to begin. *Vida* in his second Book of Silk-Worms teaches, when a young Ox is fed with Mulberry-Leaves, that out of his Flesh, after it is kill'd, will grow Silk-Worms.



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## P A R T IX.

Several Curious and Useful Instructions in the Art  
of DISTILLING.

*How to extract the Quint-Essence of Roses.*



TAKE fresh Roses, which are gather'd before Sun Rising; whilst the Dew is upon them; bruise or stamp the Leaves thereof in a Stone Mortar, then put them into an earthen glaz'd Pan or Bowl; cover them close, and let them stand till they putrify, which you may perceive when the Scent thereof is sour, and turns so in about 12 or 14 Days; you may mix up with the Leaves a little Salt of Tartar, for this penetrates, cuts, and parts the contrary Particles, and will cause each the better to separate.

After the Rose-Leaves are thus putrified, take the fifth or seventh Part of them, put them into a Glass Cucurbit, and still them in *Baln. Mar.* The distill'd Water pour upon the other Part of the Leaves, and after you have emptied the Cucurbit of the first Leaves, put in the second Part, and still them in *Baln. Mar.* as before; thus repeating it, you will draw a rectified Water, which contains the Spirit, and must be separated in the following Manner: Put all the Water you have still'd, into a Matraass with a long Neck, and a Head belonging to it, lute to it a Receiver; then with a slow Ash-Fire draw off the Spirit; and as there will go some of the Phlegm along with it, the Spirit must be, together with the Phlegm, put to another Distillation, with a slower Fire; and thus you will have a pure Spirit of Roses, which will diffuse its strong Scent as soon as the Matraass is open'd, over the whole Room.

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Save this Spirit, well clos'd up in a Phial, as a precious and valuable Thing; for its Virtue is wonderful and admirable. Pour the greater Part of the distill'd Rose-Water over the already distill'd Rose-Leaves, in order to extract the Oil from the Water; which must be done by distilling it over a hotter Ash-Fire, than you did the Spirit: The Oil will separate itself from the Phlegm, and swim on the Surface of the Water in a Gold-Colour; and although the Quantity is but small, the Virtue thereof is the greater and the more valuable.

Separate this Oil from the Phlegm, and put it up apart by itself, and also the distill'd Rose-Water in a Glass by itself; after which take the distill'd Rose-Leaves, from which all the Spirit and Oil is extracted, burn them in a Crucible to Ashes, and in burning add a little Sulphur to them, give the Ashes a fierce Fire, and they will be as white as Snow.

These Ashes put into a Glass or Earthen Vessel, pour over them the above Phlegm or Rose-Water; boil it well, so long till the Water has extracted all the Salt from the Ashes; then filter it through a brown Paper into a Matrafs; distill it, and carry off the Phlegm, and a clear Salt will settle at the Bottom of the Matrafs: The Ashes you may calcine a-new in a strong reverberatory Fire, then boil them up again with the Phlegm, and draw out the Salt as before; this repeat till all the Salt is extracted, and there remains only a poor earthy Substance.

In this Manner are extracted from Roses the three pure Capital Parts, *viz.* Spirit, Oil, and Salt; from the three impure Parts Phlegm, Water, and *Cap. Mort.*

In case the Salt should not be clean enough, you must dissolve it again in the Phlegm, and repeat your Process by Distillation, as before, and you may make it as fine as you will.

Each of these Substances has for itself great medicinal Virtues, but much more if all three are united together, which is done in the following Manner:

Put the clear Salt into a Glass Phial with a long Neck, and set it in a gentle Warmth; pour on it some of the Oil, and continue the Warmth till the Salt and Oil are united; then put another Part of Oil to it, and thus by uniting them by Degrees, your Boiling is finish'd. Then add to it one Part of the Spirit, and augment the Quantity by slow Degrees, as you did with the Oil; and thus the three Substances will be united, that no Art is able to part them, and the medicinal Virtues thereof are inexpressible.

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*Another Method to extract the Quint-Essence out of any Vegetables.*

**T**AKE a Plant, Herb, or Flower, in the Month they flourish best; gather thereof before Sun-rising (with the Dew upon) what Quantity you please; chop it fine, and fill therewith a Glass Matrafs; lute a Head over it, and place the Matrafs in *Baln. Mar.* let it infuse over a very slow Fire for a Fortnight, after which time augment your Fire; when you find some of the Menstrum will go over into the Receiver, then take your Matrafs out of the *Balneum*, and you will see the Herb infused in its own Juice, which pour off into a clean Glass: The Remains of the Herb take out of the Matrafs, burn them to Ashes, and extract the Salt thereof with a Water distill'd from the same Herb.

*How to abstract Oil of Herbs, Flowers or Seeds.*

**F**ILL a large Cucurbit with Herbs, Flowers, Seeds or what you chuse, infuse it in good *Spiritus Salis*, set it in Sand, and give it Fire enough to boil, and the Oil, as well as the Phlegm, will distil over into the Receiver; which you separate as has been directed; the Spirit you pour off, rectify it, and you may use it again for the like Process.

*A fine Secret to distil Herbs, so that the Water will retain both the Colour and Taste thereof.*

**T**AKE the Leaves of the Herb you design to distil, infuse them for a Night and a Day in Rain-Water, then take a Still Head, pour into it some of the Water from off the Herbs, swing or rinse it about, and pour it through the Pipe on the Herbs again; fling more fresh Leaves upon it, put on the Head, lute it close, and distil it in *Bal. Mar.* with a slow Fire, and you will see the Drops, which have the Colour of the Herb or Flower. When you have distill'd it all over into the Receiver, then burn the Leaves to Ashes, and extract the Salt from it in the Manner above directed; put half of it into the distill'd Water, let it dissolve in the Sun, and the Colour will be clear and fine.

*To prepare a fixed Salt out of Vegetables.*

**T**AKE Herbs, what Quantity you please (those that shoot up in long Stalks are the best for this purpose); burn them to Ashes in an open Place, or upon the Hearth; take of the Ashes and put as much as you will into a Kettle; pour Water upon it, and let it boil; then filter the Lee through a Linnen Rag, and pour fresh Water on the remaining Ashes; boil and filter it as before, and this continue to repeat till you can perceive no sharpness in the Ashes.

Then pour all the Lee into one Kettle, and boil it over a fierce Fire, till the Salt remains dry at the Bottom; of this take 12 Ounces, yellow Brimstone two Ounces, both well pulverised, and mix'd together; put some of this in the Iron Chaldron, which is made pretty hot, and in which you before boil'd your Salt; let the Brimstone burn gently away, taking care not to make the Cauldron too hot, lest it should occasion the Salt to melt, which to prevent stir the Matter continually, whilst the Sulphur is burning, with a Spatula: When you find the Sulphur consumed, put the remainings upon a clean Paper; put more of the mixture into the Chaldron and proceed as before, till you have burn'd all the Sulphur; then put them with Sulphur Salt calcined all together into the Cauldron, and make it red hot; so that if there should be any Sulphur left, it may be consumed, and the Salt become a Whitish Gray Colour; take it then off the Fire, pour, whilst it is hot, cold Water to it, and it will dissolve it immediately; then filter it through a brown Pasteboard or Paper; if the Sulphur is all clear from it, the Solution will be of a Whitish Yellow; if not, it will either be Green or of an Iron Grey.

This filtrated Solution pour again in the clean Cauldron, set it upon a Wind-Furnace, draw it off dry, and give it so long Fire till the Salt is red hot; when so, pour again quickly some Water upon it, and it will dissolve; repeat this, till by taking a little of the Solution into a Spoon, and holding it in the Light, you see not the least Film or Star on the Surface thereof; but if you do, take it off the Fire, and filtrate it into a clean Cucurbit, set it in warm Sand, and let it evaporate, without giving it the least motion, and in two or

three

three Days, according to the Quantity of the Salt, it will shoot into fine Crystals, and when it has done Crystallising, there settles a Crystalline Crust upon the Surface; let it cool, take out the Crystal, and the remaining Liquor place again upon the warm Sand, to evaporate and shoot in Crystals.

You must observe not to be too sparing with your Water which you pour upon the red hot Salt, before you filter it, else the Salt would settle at the Bottom, and shoot no Crystals.

If it should happen, that in burning the Brimstone your Salt should dissolve; then take it off the Fire, let it cool, and beat it in a Mortar; and after you have dissolv'd and calcin'd it, burn it once again with the Sulphur, and then use it with the rest.

The Ashes burn'd of green Herbs, or of such as are not too dry, yield more fix'd Salt than such as are dry'd up.







## PART X.

## Several Secrets relating to MARBLE.

*How to stain Marble that's White, and paint upon it with various Colours; which will penetrate into the Stone so as to bear polishing.*



TAKE of Aqua Fortis two Ounces, Sal Armoniac one Ounce, of high rectified Spirit of Wine four Drams; then take some Gold, make of it an Amalgama with Mercury or Quicksilver, let the Mercury evaporate, and the Gold will remain at the Bottom of your Crucible like a brown Powder or Calx: Dissolve this in Aqua Regis, and evaporate it till it is of a yellow Colour; then pour on the Sal Armoniac and the Spirit of Wine, and when dissolv'd, evaporate the Spirit again, and there remains a bright Gold Colour.

Calcine the Silver in a Phial, and then let the Aqua Fortis evaporate till you have a Sky Colour, which take off and preserve in a clean Phial, keeping the rest in a warm Sand to evaporate, and you will have a deep Blue, which you also preserve, the remains will, by more evaporating, turn into Black.

By mixing these Colours you may produce several others; wherewith you may paint or stain what Figures you please; and the more you repeat laying on this Colour, the deeper they will penetrate into the Stone, and the stronger they will represent themselves thereon. After you have finished your Staining, you may polish it like plain white Marble, and then you will have the Colours appear in their full Lustre.

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Marble may also be stained with Colours which have been drawn from Vegetables, with *Spirit. Sal. Armoniac.* or Urin; but, although they penetrate a good Way into the Marble, they will, on Account of their volatile Nature, be of no long Duration: The red Colour in this Process is made of Dragon's Blood, tempered with Urin of Horses, Hogs, or Dogs; the Blue is treated in the same Manner, for which they use blue Verditer: The Purple Colour is drawn from Cochineal, mix'd with any of the said Urine; some, instead of Urin, use Spirit of Wine.

*To imitate Marble.*

**T**AKE Plaister of Paris, Quick-Lime, Salt, Ox-Blood, Stones of different Colours, also Pieces of Glass, all beat to Powder, and mixt up to the Consistence of a Paste, with Vinegar, Beer or four Milk, and then lay it into Tables, Pillars, or what you will; let it stand so long till it is thorough dry; then rub it first with Pumice, and polish it with Tripoli, giving it the finishing Stroke with rubbing it over with Leather and Oil.

*Another Method*

**W**ITH fine pulveriz'd Plaister of Paris, and Size of Parchmens, make a Paste, mix with it as many Colours as you please, spread it with a Trowel over a Board, and when dry, proceed as before.

*To paint on Wood in Imitation of Marble.*

**F**IRST lay a Ground (repeating it seven or eight times) with white, as you have been directed in the Method of gilding on Wood; then you marble it with what Colours you please, after you have tempered them with the white of Eggs, and mix'd a little Saffron Water with it. If you are not used to-marbling with a Pencil, you may pour one Sort of your Colour here and there a little, upon the white prepared Table, then holding and turning it shelving, the Colour will disperse all over the Ground in Varieties of Veins; then with another Colour proceed in the same Manner, and so with as many as you think proper, and it will answer your Purpose: After it is dry, you may with a Pencil

give it a Finishing by mending such Places as are faulty; then you may lay on a Varnish, and polish it in the best Manner you can.

*To imitate a Jaspis.*

**T**AKE Quick-Lime, mix it with the white of Eggs, and roll it up in Balls, this will serve for the White; for Red mix along with it Lake or Vermillion; for Blue add Indigo or Prussian Blue; for Green use Verdegrease, and so on.

When you have made many different Sorts of colour'd Balls, to the Consistence of a Dough, then flat them with a Rolling-Pin, as you would Pyc-Crust, lay them one upon another, and with a thin Knife-Blade, cut it in long Pieces, and mix them confusedly in a Mortar together; then with a Trowel spread it over a Table, Pilasters, &c. very smooth and even; when dry, pour boiling hot Oil upon it, and spreading it all over, it will soak in; then set it in a shady Place to dry.

You may, if you will, mix your Quick-Lime and your Colours with Oil at first, and then there will be no Occasion to oil it afterwards.

*How to clean Alabaster or white Marble.*

**B**EAT Pumice Stones to an impalpable Powder, and mix it up with Verjuice, let it stand thus for two Hours; then dip in it a Sponge and rub the Marble or Alabaster therewith; wash it with a Linnen Cloath and fresh Water, and dry it with clean Linnen Rags.

*To imitate Marble in Brimstone.*

**T**O do this, you must provide your self with a flat and smooth Piece of Marble, on which you make a Border or Wall, to encompass either a Square or Oval Table, which you may do either with Wax or Clay. When this is done, provide and have in readiness several Sorts of Colours, each separately reduced to a fine Powder; as for Example; White Lead, Vermillion, Lake, Orpiment, Masticor, Smalt, Prussian Blue, and such like Colours. After you are provided with them, then melt on a slow Fire in several

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several glaz'd Pannikins some Brimstone; put in each one particular Sort of Colour, and stir it well together; then having before oil'd the Marble all over within the Wall, drop with one Colour quickly spots upon, of large and less Sizes; then take another Colour and do as before, and so on, till the Stone is covered with Spots of all the Colours you design to use; then you must consult what Colour the Mass or the Ground of your Table is to be; if you will have it of a Grey Colour, then take fine sifted Ashes, and mix it up with melted Brimstone, or if red, with *English* red Oaker; if White, with white Lead; if Black, with Lampblack or Ivory Black. Your Brimstone for the Ground must be pretty hot, so that the Drops upon the Stone may unite and incorporate together; when you have pour'd your Ground even all over, then, if you will, put a thin Waincot Board upon it; but this must be done whilst the Brimstone is hot, making also the Board, which must be thorough dry, as hot as it will bear, in order to cause the Brimstone to stick the better to it, and when it is cold, polish it with Oil and a Cloath, and it will look very beautiful.

*To imitate a Porphyre.*

TAKE Red Oaker and Lake, grind it with Water of Gum Tragant; then, either on a Glass, Marble or a smooth Board (before anointed all over with Oil) you sprinkle out of a Brush or Feather, the Glass or Table, all over with that Colour; and having sprinkled it all over, mix Brown Red, or if that is too Red, add some Umber or Soot to it, mix it up with Gum Tragant to the Substance of a thick Paste, and roll it on the Glass, over the sprinkled Colours, as thick as you please; then let it dry, and when you are sure that it is thorough dry, you may polish it.

*How to make Fret Work Cielings.*

TAKE Pebble, stamp them fine in an Iron Mortar, searce it through a fine Hair Sieve, then take of powder'd Lime one Part, of the Pebble Powder two Parts, and mix it together with Water; then take the Mixture, and lay it all over the Cieling, very smooth; carve then on it what you please, or lay to it some Ornament with Moulds, which are cut  
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in smooth Wood, or cast in Lead, fill the Form with the Mixture, press it to the Cieling, and it will stick and come clean out of the Mould; let it dry, and when dry, and you perceive that it is not every where of a good White, then with a clean Pencil Brush and clear Water strike it over, and it whitens of itself. It will in Time grow as hard as Stone.



## PART XI.

Plain Instructions for LIMNING and for Colouring COPPER-PLATE PRINTS, MAPPS, &c. with *Water-Colours*.

*Of the Colours generally used in that Art.*

For White use	<ol style="list-style-type: none"> <li>1. White Lead.</li> <li>2. Flake White.</li> <li>3. Musc Silver.</li> </ol>		
Blue	<ol style="list-style-type: none"> <li>1. Indigo.</li> <li>2. Blue Lake.</li> <li>3. Blue Verditer.</li> <li>4. Smalt.</li> <li>5. Ultramarine.</li> <li>6. Latmus.</li> <li>7. Blue.</li> </ol>	Yellow	<ol style="list-style-type: none"> <li>1. Yellow Oaker.</li> <li>2. Masticote.</li> <li>3. Pale Masticote.</li> <li>4. Dutch Pink.</li> <li>5. Gamboge.</li> <li>6. Naples Yellow.</li> <li>7. Shell Gold.</li> </ol>
Red	<ol style="list-style-type: none"> <li>1. Vermillion.</li> <li>2. Red Lead.</li> <li>3. Red Oaker.</li> <li>4. Lake.</li> <li>5. Carmine.</li> </ol>	Green	<ol style="list-style-type: none"> <li>1. Sap Green.</li> <li>2. Verdegrease.</li> <li>3. Terre Verde.</li> </ol>
		Brown	<ol style="list-style-type: none"> <li>1. Brown Oaker.</li> <li>2. Chimney Soot of a Wood Fire.</li> <li>3. Colln's Earth.</li> <li>4. Umber.</li> </ol>
	Black		<ol style="list-style-type: none"> <li>1. Lamp-Black.</li> <li>2. Ivory Black.</li> <li>3. Sea-Coal Black.</li> <li>4. Indian Ink.</li> </ol>

Out of these Colours you may temper all the rest which your Work may require.

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Some Colours are to be washed and ground, as for Instance,

1. White Lead. 2. Brown Oaker. 3. Dutch Pink. 4. Umber. 5. Colln's Earth. 6. Ivory Black.

Some are only to be wash'd, and are, 1. Red-Lead.

2. Masticot. 3. Blue Bise. 4. Smalt. 5. Ultramarine. 6. Vermillion.

Others are only steep'd in fair Water, as, 1. Gamboge.

2. French Yellow, to which you must add a little Allum. 3. Sap-Green. 4. Blue Lake. 5. Letmus.

And others again are only ground, viz. 1. Flake White.

2. Indigo. 3. Lake. 4. Carmine. 5. Distill'd Verdegrease.

All your Colours you grind with fair Water on a hard Stone, or on a Piece of Looking-Glass, which you fix with white Pitch and Rosin upon a flat Board, having also a Muller of that Kind.

Of the Colours (after you have ground them very fine) you may take as much as will serve your present Occasion, and temper 'em in a Gallipot or Shell with Gum-Water, in which you have also dissolv'd a small Matter of Sugar-Candy. You must observe, that Colours which are very dry, require a stronger Gum-Water, in others it must be used very sparingly.

If your Colours won't stick, or the Paper or Print be greasy, mix a very little Ear-Wax, or a little Drop of Fish or Ox-Gall among your Colour; you may dry your Fish or Ox-Gall and dilute it when you have Occasion for it, with a little Brandy. If your Paper or Print sinks, then with clean Size and a sponge wipe it over, after you have fastened the Edges round upon a Board, and let it dry.

You must chuse Pencils of several Sizes, agreeable to the Work you are to use them for; as for laying on a Ground a Sky or Clouds, chuse a larger Size than those that you use for Drapery, Trees, &c. wherein you must follow your own Reason: Those Pencils of which the Hairs (after you have wetted them between your Lips, and turn'd them upon your Hand) keep close together, are the best.

*To paint or colour a clear Sky.*

**T**AKE clear blue Verditer, mix'd with a little White; with this begin at the Top of your Landskip or Picture, and having laid on the Blue for some space, break it with a little Lake or Purple, working it with a clean Pencil, one Colour

it with a clean Pencil, one Colour imperceivably into another; apply more White and Masticore, in order to make it fainter and fainter towards the Horizon, working all the while the Colours imperceptibly one into another, from the Horizon to the Blue Sky; after which you may lay some stronger Strokes of Purple over the Light, so as to make them appear like Clouds at a Distance.

For a fiery red Sky, you use Red-Lead and a little White, instead of the Purple Streaks or Clouds, working them according to Art imperceptibly one into another.

Clouds you lay on with White and Black, sometimes you mix a little Purple along with; but the best and surest Direction you may enquire for of Nature herself.

*To lay a Ground for Walls of Chambers, Halls, &c.*

**Y**OU must use for a common Wall, which is of a reddish Hew, Brown, Red and White, and temper your Colour according to the Newness or Decay thereof; shade it with Brown-Red, only mix'd with a little Bitre or Soot.

Other Walls you lay on with Black and White, and shade it with the same Colours; sometimes you mix a little Purple along with it, and then you shadow it with Black and Lake.

For Wainscoting, that is embellish'd with carv'd Mouldings and Figures, you must use one Colour, for both the Plain and the Carve-Work, shading and heightning it with Judgment and Care.

To paint a Fore-Ground, in Imitation of Sand or Clay, lay on the darker Parts with Brown-Oaker; to what is in their Distance, add a little White, and so on in Proportion; shading it with Brown Oaker, and the strong Shades with Soot.

In a Carnation or Flesh-Colour, use for young Women and Children Flake-White, light Oaker, and a little Vermillion: Some add a little Lake, but that must be but a very small Matter, and having laid on the Colour for the Carnation, you shade the Features about the Lips, Cheeks, Chin, Knees, and Toes, with fine Lake and Vermillion, shadowing the naked Part with Sea Coal and a little Lake, or Brown-Red, or with Brown Oaker and Lake, or else Indian-Ink or Lake; for a brownish Complexion, you mix a little Brown Oaker among the Carnation-Colour.

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For ancient People, use Vermillion, Brown-Oaker and White, shade it with Bitre and Lake.

A dead Corps of a young Person you paint with Flake-White, Brown-Oaker and a little Indigo, or Sea-Coal, and shade it with Bistre or Sea-Coal.

For an old dead Corps, you leave out the Indigo, but shade it as before.

For the Hair of young Women and Children you lay them on with light Oaker, shade them with deep Oaker, and heighten them with Masticot and White.

Grey Hair you lay on with Black and White; shade them with Black, and heighten them with White, and thus you proceed in painting any other colour'd Hair.

Trees, are laid on, some with White, Black and Bitre, shaded with brown Oaker, and heighten'd with the same Colour, with more White in it. Those that stand at a distance, are laid on with Indigo Blue, Brown Oaker and White, and shaded with Indigo and Brown Oaker. Those that are further distant you lay on faint, and shadow them but slightly; which Order you must observe in colouring of Ships, Houses, and other Buildings.

In thatch'd Houses you paint the Thatch or Straw, when new, with *Dutch* Pink, and shade it with Brown Oaker, and to heighten the Straw, you use Masticot and White. Old Straw, you lay on with Brown Oaker, sometimes mix'd with Black and White; the Straw you heighten with Brown Oaker and White.

In colouring Cities, Castles or Ruins, you must observe Nature and cannot well be taught; but however to give a Beginner a little more light in that Affair, you must observe that those Houses which lay nearest the Fore Ground must be colour'd with Vermillion and White, adding to it a little Brown Oaker; shading it with that and some Bitre; the heightenings are, upon occasion, done with Vermillion and more White.

Houses that lay further distant, are laid on with Lake and a little Blue and White, shaded with Blue and Lake, and heighten'd with adding more White.

Such Buildings as lay still further, are laid on with a faint Purple and a little Blue, shaded softly with Blue, and heighten'd with White; and the further they are off, the fainter and slighter must be your Colour.



In colouring of Rocks, Hills, &c. that are at a great Distance, you observe the same Rule. Such as lay nearer the Fore-Ground, you imitate according to Nature. Trees that are upon the Fore-Ground, you paint with several Sorts of Greens, the better to distinguish one from the other; such as are on distant Hills, must be done with the same Colour as the Hills.

*How to Paint or Colour Cattle.*

**H**ORSES of Chesnut Colour, you lay on with brown Red, shaded with Brown Red and Black, and heighten it with Brown Red, White and Yellow; the Main and Tail of Horses you may make White, as also the lower part of their Feet.

One of an Ash-Colour you lay on with Black and White, shade it with a blueish Black, and heighten it with White.

A black Horse, you lay on with all Black, shade it with a deep Black, and heighten it with Black and White.

A white Horse, you lay on with White-Lead, just tainted or broke with a little Red, shade it with black and white, and heighten it with pure White.

Spotted Horses must be done according as Nature directs; and by these Directions you will govern yourself in painting or colouring any other Sort of Cattle.

Sheep you lay on with White, broke with a little Bitre; use in the Shadows a little Black.

Hogs or Pigs, you lay on with Brown-Oaker and Yellow Oaker, and shade it with Bitre.

A Bear is laid on with Brown-Oaker, Black and Brown-Red, shaded with Bitre and Black, and heightened with Brown-Oaker and White.

A Leopard is laid on with Yellow-Oaker, and shaded with Bitre: The Spots are laid on with Bitre and Black; the Mouth with Black and White.

An Ass is commonly of a Grizzle, and laid on with Black and White, broke with a little Oaker.

An Elephant is laid on with Black and White and a little Bitre.

A Monkey is laid on with Dutch Pink, Bitre and Black, the Hair is heightened with Masticote, White and a little Bitre; the Paws must be shaded off with Black and Brown Red, with a little White.

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A Hart is laid on with Brown-Oaker and English Red, and shaded on the Back and where it is requisite, with Bitre and Brown-Red; a Streak of White must be below the Neck, as must be the Belly and Breast of a white Colour.

A Hare is laid on with Brown-Oaker, which loses itself by Degrees into White under the Belly; the Back is shaded with Bitre, and the Hair is heighten'd with Oaker and White.

A Rabbit is laid on with White, Black, and Bitre, the Belly is White: These Creatures are of various Colours, which may be imitated after Nature.

### *Of Birds.*

A Falcon is laid on with Brown-Oaker, black and white, shaded with a pale black; the Feathers must be display'd and shadow'd with black, the Breast is white, the Legs are laid on with yellow, and shaded with Brown Oaker and Bitre.

A Turkey Cock or Hen, is laid on with black and white, and shaded with black, working the Colours lighter and lighter towards the Belly, which must be all white; the Legs are laid on with Indigo and White, and shaded with Blue; when they are irritated, the Substance about their Bill must be laid on with Vermillion and Lake, deepening it with stronger Lake; otherwise when they are calm, that Part is a little upon the Purple.

A Swan is laid on with White, with a little Bitre, and heighten'd, where the Feathers seem to raise, with pure White: The Feet are blackish, and the Bill red, with a black Rising at the upper End.

Pidgeons, Drakes, Hens, are of so many various Colours, that there would be no End to give proper Lessons for every one, and thus it is with many other Birds, which an Artist ought to copy after Nature.

### *Of Fruit.*

APPLES are laid on with fine Masticot mix'd with a little Verdegrease, or a little White, French Berry, Yellow and Verdegrease; shade it with Brown Oaker and Verdegrease, or Lake; heighten it with Masticot and White.

White, and the strongest Light with White alone; but you must regulate yourself to the Colour of the Apples as well as Pears.

Cherries are laid on with Vermillion and Lake, shaded with pure Lake, and heightened with Vermillion, or Vermillion and a little White.

White-Heart Cherries, are laid on in the middle with Vermillion, Lake and White, working it to a Yellow towards the Stalk, and with Lake towards the Top.

Morello's are laid on with Lake and a little Black, shadow'd with Black, and heightened with Vermillion, Lake and Black; this must be so intermix'd that the Colours may seem all of one Piece.

Mulberries are laid on with Lake and Bitre, shadow'd with Black, and heightened with Vermillion; on the highest Lights give little Dots with Lake and White.

Strawberries are laid on with a yellowish White, then shaded with Lake and Vermillion, and heighten the Knobs with White and Vermillion.

Grapes, the Black ones are laid on with Purple, shaded with blue Verditer and Indigo, and heightened with White.

The white Grapes are laid on with pale Verdegrease, a little Masticote and White; the blue Bloom is very gently with a blunt Pencil just touch'd with the Blue Verditer dubb'd over them.

Peaches and Apricocks are laid on with light Masticote, or French-Berry Yellow, and White, shaded with Red-Oaker and Yellow; if there must be a Bloom upon them, you do it with Lake, and heighten it with White as you do the Grapes; some are of a more greener Colour than others, wherein you are to copy Nature as it lays before you.

Radishes and Turnips, are laid on with White, shaded with Indian-Ink, and at the Top with Lake; working it down faint into White towards the Bottom. The Top is laid on with Verdegrease and Sap-Green, shaded with Sap-Green and Indigo, and heightened with Masticote.

Carrots, are laid on with Yellow Oaker, and if they are of a high Colour it is mix'd with Red Lead; they are shaded with Brown Oaker, Yellow Oaker and Bitre, and heighten'd with Masticote. For the rest I direct the Practitioner to Nature.

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*Of Flowers.*

**R** OSES are laid on with a pale Carmine and White, shadow'd with Carmine and less White, and the deepest with Carmine by itself; the Heart you make always darker than the rest. The Seed in open blown Roses is Yellow.

Tulips are of various Kinds, Colours, and Shapes; it is impossible to give certain Rules for colouring them.

Some are done with Lake and Carmine on White, mix'd together; others with Purple, laid on with Ultramarine, Carmine and Lake; sometimes bluer, and sometimes redder; these Colours must be streak'd according to Nature. Those of one Colour, as Yellow, Red, &c. are laid on with such Colours, and if there appear any Streaks you must make your Colour either lighter or deeper, as Nature directs.

Emonies are of several Sorts, some are laid on with Lake and White, and finish'd with the same. Others with Vermillion and shadow'd with that Colour, Carmine and Lake. Yellow ones are laid on with Masticote, and shadow'd with that and Vermillion, sometimes with brown Lake.

Red Lilies are laid on with Red Lead, shaded with Vermillion and Carmine.

The Piony is laid on with Lake and White, and shaded with the same Colour with less White.

Yellow Cowslips are laid on with Masticot, and shaded with Gumboge and Umber. Purple ones are laid on with Ultramarine, Carmine and White, and shadow'd with less White.

Carnations and Pinks are manag'd like Emonies and Tulips. Some Pinks are of a pale Flesh-Colour, streaked with another that's a little higher; this is done with Vermillion, Lake and White, and streaked without White.

The Blue Hyacinth, is laid on with Ultramarine and White, and shaded with less White.

The Red or Gridiline, is laid on with Lake and White, and a little Ultramarine; and finish'd with less White.

The White Sort, is laid on with White, and shadow'd with Black and White.

The Crocus are two Sorts, *viz.* Yellow and Purple. The Yellow is laid on with Masticote, and shaded with Gall-stone or Gumboge; after which upon each Leaf on

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the outside are made three separate Streaks with Bitre and Lake. The Purple ones are laid on with Carmine, Ultramarine and White, and finish'd with less White; the Streaks must be very dark on the outside of the Leaves. The Seed of both is Yellow.

*Of Metals.*

**G**OLD is laid on with Red Lead, Saffron, and Yellow Oker, shadow'd with Lake and Bitre, in the deepest Places with Bitre, Lake and Black, then heighten'd with Shell-Gold.

Silver is laid on with White, shadow'd with Black and Blue, and heighten'd with Shell-Silver.

Tin or Pewter is done the same Way, only it is laid on with White, mixt with a little Indigo.

Iron is done like Tin.

Brass is done in the same Manner as Gold, only the Shades must not be so strong.

Copper is laid on with Brown-red and White, shadow'd with Brown-red, Lake, and Bitre, and heighten'd with Brown, Red, and White.

These Directions will be sufficient to guide young Practitioners to Nature, which is the best School they can go to, to their Live's



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APPENDIX  
TO THE  
LABORATORY  
OR  
*SCHOOL of ARTS:*

CONTAINING,

I. Plain Instructions in the  
Art of Dying SILKS, WOR-  
STEDS, COTTONS, &c. of  
various Colours.

II. Proper Lessons for pre-  
paring and managing all  
Sorts of ROCKETS, CRAC-

KERS, FIRE WHEELS,  
FIRE GLOBES, BALLS,  
STARS, SPARKS, &c. in  
the executing of artifi-  
cial and recreative FIRE-  
WORKS.

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*Translated from the HIGH DUTCH.*

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Illustrated with COPPER-PLATES.

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L O N D O N :

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[ Price One Shilling. ]

APPENDIX

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# APPENDIX

To the SECOND EDITION of



## LABORATORY

OR

## SCHOOL of ARTS.

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The Art of dying SILKS, WORSTEDS, COTTONS, &c. of various Colours.

**T**HE art of dying in colours, is of great antiquity, as appears both from sacred and profane history; but who were the first inventors thereof, is uncertain; however, for the generality it is conjectured that like many others it had its first birth by accident: the juices of certain fruits, leaves, &c. accidentally crushed, are supposed to have given the first hint. Purple, an animal juice, found in a mussel, was first discovered to be of a tinging quality, by a dog's catching one of the purple-fishes among the rocks, which in eating stained his mouth with that precious colour: this colour was in so high esteem among the *Romans*, that none but their emperors were suffered to wear it. I could give the curious a long historical and speculative account concerning this ingenious art, but

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that being a subject not suitable to the intent of this work, I shall only inform my readers in the practice thereof, in as concise and plain a manner as possible. My first lesson is:

*How to dye Silk or Worsted of a fine Carnation Colour.*

**F**IRST take to each pound of silk, four handfulls of wheaten bran, put it in two pails of water, boil it, pour it into a tub, and let it stand all night; then take half the quantity of that water, put into it  $\frac{1}{2}$  a pound of allum,  $\frac{1}{4}$  of a pound of red tartar, beaten to a fine powder, and  $\frac{1}{2}$  an ounce of fine powdered curcumi; boil them together, and stir them well about with a stick; after they have boiled for a quarter of an hour, take the kettle off the fire, put in the silk, and cover the kettle close to prevent the steam from flying out; leave it thus for three hours, then rince your silk in cold water, beat and wring it on a wooden pin, and hang it up to dry.

Then take  $\frac{1}{4}$  of a pound of gallnuts, beat them fine, and put the powder thereof into a pail of river-water; boil it for one hour; then take off the kettle, and when you can bear your hand therein, put in your silk, and let it lay therein an hour, then take it out and hang it up to dry. When the silk is dry, and you would dye it of a crimson colour, weigh to each pound of silk,  $\frac{3}{4}$  of an ounce of cochineel, which beat to a fine powder, and sift it through a fine hair sieve; then put it in the pail with the remaining lee, and having mix'd it well, pour it into a kettle, and when it boils, cover it well to prevent any dust coming to it; after you have put in  $\frac{3}{4}$  of a pound, and two ounces and a half of tartar, both finely powdered, let it boil for  $\frac{1}{2}$  of an hour; then take it off the fire, let it cool a little, and put in the silk, stir it well with a stick to prevent its being clouded, and when cold wring it out. If the colour is not deep enough, hang the kettle again over the fire, and when it has boiled and is grown lukewarm again, repeat the stirring of the silk therein; then hang it upon a wooden pin which is fastened in a post, wring and beat it with a stick; after this, rince the dy'd silk in hot lee, wherein to one pound of silk, you have dissolved  $\frac{1}{2}$  an ounce of *Newcastle* soap, afterwards rince it in cold water. Hang the skeins of raw-silk on a wooden pin, putting a little hand-stick to the bottom part, and



and thus having worked, wrung, and beat it round, you must hang it up to dry.

*Another Method to dye Silk of a crimson Red.*

**T**AKE of good Roman allum  $\frac{1}{2}$  an ounce, tartar one ounce, spirit of vitriol  $\frac{1}{4}$  of an ounce, and put them pulverized into a pewter kettle, and pour as much water on them, as is sufficient for the quantity of  $\frac{1}{2}$  an ounce of the silk you propose to dye; when it is ready to boil, put in the silk, which before you must boil in bran; boil it for an hour or more, then wring it out, and put to the liquor  $\frac{1}{2}$  an ounce of cochineel finely powdered, and 60 drops of spirit of vitriol; when ready to boil, put in the silk again, and let it soak for four hours; then take clean water, drop into it a little spirit of vitriol, rince therein the silk, take it out again, and dry it on sticks in the shade. This will be a high colour, but if you would have it of a deep crimson, you take instead of spirit of vitriol, spirit of sal armoniac, to rince your silk in.

*General Observations in dying Crimson, Scarlet, or Purple.*

1. **Y**OUR copper or kettle must be of good pewter, quite clean and free from any foil or greafe.
2. The prepared tartar must be put in when the water is lukewarm.
3. If you intend to dye woollen or worsted yarn, you may put it in the first boiling, and let it boil for two hours.
4. When boil'd take it out, rince it, clean the kettle, and put in the water for the second boiling.
5. This second boiling is performed in the same manner as the first; then put in cochineel finely powdered, when it boils hard, and stir it well about.
6. Then the silk, which before has been washed and cleansed in the first lee, is put in on a winch, which is continually

nually turned about, in order to prevent the colours from fixing in clouds.

7. When the colour is to your mind, take it out of the copper, rince it clean, and hang it up in a room or a shady place, where it may be free from dust.

8. You must observe, that when the aqua fortis, is put into the second boiling, it causes a coarse froth to swim at top: which you must carefully take off.

*How to dissolve the Pewter for Dyer's Aqua Fortis.*

**T**AKE fine pewter, pour first a little clear water over it, then pour on the aqua fortis, which will dissolve it. The solution is of a whey or milk colour, temper it by adding more aqua fortis, till it is clear. The common proportion is, to one ounce of aqua fortis add a quarter of an ounce of pewter.

*To dye a Crimson with Orchal.*

**P**UT clean water into the copper, and to each pound of silk take 12 ounces of orchal: in this turn your silk and wring it out; then dissolve to each pound of silk  $\frac{1}{4}$  of a pound of allum, and as much of white arsenic; in this liquor put the silk all night to soak; then wring it out; this done, take to each pound of silk, two ounces of cochineel, two ounces of galls, two ounces of gum, with a little curcuma: in this boil the silk for two hours; then put in a little zepfie, let it soak all night, and in the morning rince it out.

*To dye a Violet Colour.*

**F**IRST boil your silk in bran and allum, as has been shewn above; then clean your copper, and with clean water, put to each pound of silk, one pound of galls, one ounce and a half of cochineel finely powdered, and one ounce of gum arabick, boil it together like the crimson red; leave it all night, and the next morning take out your silk, and rince it in fair water.

*To*

*To the LABORATORY, &c.*

*To dye Worsted, Stuff, or Yarn of a Crimson Colour.*

**T**AKE to each pound of worsted, two ounces of allum, two ounces of white tartar, two ounces of aqua fortis,  $\frac{1}{2}$  an ounce of pewter,  $\frac{1}{4}$  of a pound of madder, and  $\frac{1}{4}$  of a pound of logwood, put them together in fair water, boiling the worsted therein for a considerable time; then take it out of the copper, and when cool, rince it in clean water: then boil it again, and put to each pound of worsted,  $\frac{1}{4}$  of a pound of logwood.

*Another Method.*

**T**AKE to eight pound of worsted, six gallons of water, and eight handfuls of wheaten bran; let them stand all night to settle, in the morning pour it clear off, and filtrate it; take thereof half the quantity, adding as much clear water to it; boil it up, and put into it one pound of allum, and half a pound of tartar; then put in the worsted, and let it boil for two hours, stirring it up and down all the while it is boiling with a stick. Then boil the other half part of your bran-water, mixing it with the same quantity of fair water as before; when it boils put into it four ounces of cochineel, two ounces of fine powder'd tartar; stir it well about, and when it has boiled for a little while, put in your stuffs: keep stirring it from one end of the copper to the other with a stick, or turn it on a winch, till you see the colour is to your mind; then take it out of the copper, let it cool, and rince it in fair water.

*Another for Silk.*

**T**AKE to each pound of filk, a quarter of a pound of fernambuca, boil it up, and strain it through a sieve into a tub, and pour water to it, till it is just lukewarm; in this turn your filk, which before has been prepared as has been directed, and when all the strength is drawn out, rince, wring and dry it.



*Another fine Carnation.*

**T**AKE to each pound of silk, after it is rinc'd and dry'd, four pound of safflower, put the safflower in a bag, and wash it in clean water, till the water comes clear from it; then take the safflower out of the bag, press it between your hands, and rub it asunder in a clean tub; take to each pound of silk, four ounces of pot-ashes, work it well together with the safflower, divide it into two parts, pour one part thereof into a close sack, that will keep the pot-ashes from coming out, otherwise it will make the silk speckled, and pour clear water over it, to draw the strength out of the safflower; then take to each pound of silk, a quarter of a pint of lemon juice; divide that also into two parts, and put each to the two quantities of safflower: hang your silk well dryed on clean sticks, and dip it in the first part of the liquor continually for an hour; then wring it well out, and hang it again on sticks: having prepared the other part of the safflower as you did the first, dip it therein as before for the space of an hour; then wring it well and hang it up to dry in the shade, and you will have a fine colour.

*A Carnation for Woolen.*

**T**AKE four ounces of ceruse, three ounces and a half of arsenic, one pound of burned tartar, one pound of allum; boil your stuffs with those ingredients for two hours; then take it out, and hang it up: the next morning make a dye of two pound of good madder, a quarter of a pound of orlean, two ounces of curcumi, and three ounces of aqua fortis.

*To dye a Carnation on Silk or Cotton, with Fernambuca.*

**T**AKE three pound of allum, three ounces of arsenic, four ounces of ceruse; boil your silk or cotton therein for an hour; then take it out and rince it in fair water; after which make a lee of eight pound of madder, and two ounces of sal armoniac, soak the silk or cotton therein all night, then boil it a little in fair water, and put into it one ounce of pot-ashes; then pour in some of the lee, and every time you

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pour, the colour will grow the deeper, so that you may bring it to what degree or shade you please.

*Another Method.*

**T**AKE to one pound of silk, cotton, or yarn, one ounce of tartar, and half an ounce of white starch; boil them together in fair water; then put in one quarter of an ounce of cochineel, a quarter of an ounce of starch, and a quarter of an ounce of pewter, dissolved in half an ounce of aqua fortis, and mixed with fair water; when the water with the starch and tartar has boiled for some time, supply it with the cochineel and the above aqua fortis; put in your silk or whatever you have a mind to dye, and you will have it of a fine colour.

*Another Method.*

**T**AKE one ounce of tartar, starch and lemon juice of each half an ounce, and cream of tartar a quarter of an ounce; boil them together in fair water, adding a quarter of an ounce of curcumi; put in half an ounce of cochineel, and a little while after one ounce of aqua fortis, in which you have dissolved a quarter of an ounce of pewter, and then put in your silk.

*To dye Yarn or Linnen of a lasting Violet Colour.*

**T**AKE one pound of tartar, half a pound of allum, two ounces of fernambuca, and half an ounce of saltpetre; boil them together, then let them cool a little, and put in your yarn; let it soak for four hours, keeping the dye hot but not boiling, after which rinse and dry it.

*How to prepare or set a blue Vat for dying.*

**H**EAT soft water in a kettle or copper, fling four or five handfuls of wheaten bran, together with four pound of pot-ashes into it, when that is dissolved boil it for an hour, and then add four pound of madder; with this boil it for an hour longer, then pour the water into the vat, fill it not full by the height of a foot, and then cover your vat; then set it with indigo and woad, of each six pound, and two

pound of pot-ashes; put this into a small kettle in warm-water, set it on a slow fire, and let it boil gently for half an hour, stirring it all the while; then pour that to the other liquors already in the vat.

To set a vat with indigo only, you must boil the first lee with pot-ashes, four or five handfuls of bran, and half or three quarters of a pound of madder; this you boil a quarter of an hour, and when settled it will be fit for use. Then grind your indigo in a copper bowl, with an iron smooth ball very fine, pouring on some of the lee, and mixing it together; when settled, pour the clear into the blue vat, and on the sediment of the indigo, pour again some of the lee, this you should repeat till you see the blue tincture is extracted clearly from it.

It is to be observed, that the madder must be but sparingly used, for it only alters the colour, and makes it of a violet blue; which, if you design to have, cochineel is the fitter for. The mix'd colours in blue are the following: dark blue, deep blue, high blue, sky blue, pale blue, dead blue, and whitish blue.

By mixing of blue and crimson, is produced purple, columbine, amaranth, and violet colours; also from those mixtures may be drawn the pearl, silver, gridelin, &c. colours.

From a middling blue and crimson are produced the following colours, viz. the pansy, brown gray, and deep brown.

Care must be taken that in setting the blue vat, you do not overboil the lee, by which the colour becomes muddy and changeable; be also sparing with the pot-ashes, for too much thereof gives the blue a greenish and false hue; but experience is the best instructor in this.

*Another Direction how to set a Blue Vat; together with several Observations in the Management thereof, both for Silk or Worsted.*

**T**AKE half a bushel of clean beech ashes, well sifted, of this make a lee with three pails of river or rain-water, pour it into a tub, and put in two handfuls of wheat-bran, two ounces of madder, two ounces of white tartar finely

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finely powdered, one pound of pot-ashes, half a pound of indigo pounded; stir it all well together, once every 12 hours for 14 days successively, till the liquid appears green on your fingers, and then it is fit to dye, however when ready, stir it every morning, and cover it when you have done.

When you are going to dye silk, first wash the silk in a fresh warm lee, wring it out and dip it into the vat; you may dye it what shade you please, by holding it longer or shorter in the dye.

When the colour is to your mind, wring the silk, and having another tub, ready at hand with a clear lee, rince therein your silk, then wash and beat it in fair water and hang it up to dry.

When the vat is wasted, fill it with the lee, but if it grows too weak supply it with half a pound of pot-ashes half a pound of madder, one handful of wheat-bran, and half an handful of white tartar; let it stand for eight days, stirring it every 12 hours, and it will be again fit for use.

*Another Method for Woollen.*

**F**ILL a kettle or copper with water; boil it up, and put pot-ashes into it; after it has boil'd with that a little, put in two or three handfuls of bran, let it boil for  $\frac{1}{2}$  of an hour, then cover it; take it off the fire and let it settle.

Pound the indigo as fine as flower: then pour off the above lee to it, stir it and let it settle, and pour the clear lee into the vat; then pour more lee to the sediment, stir it and when settled pour that into the vat also; repeat this till the indigo is wasted. *Or,*

Take to  $\frac{1}{4}$  of a pound of indigo,  $\frac{1}{2}$  a pound of pot-ashes,  $\frac{1}{4}$  of a pound of madder, three handfuls of borax, let it boil for  $\frac{1}{2}$  an hour, and then settle; with this lee grind your indigo in a copper bowl; put this on an old vat of indigo, or on a new one of woad, and it will make it fit for use in 24 hours.



*To dye Silk of a Straw Yellow.*

**T**AKE allum and rinse your silk well, as has been directed before, then take and boil to each pound of silk, one pound of fustic or rocaw, and let them stand for  $\frac{3}{4}$  of an hour; then put into a tub, large enough for the quantity of the silk, a sufficient quantity of that lee and fair water; in this rinse the silk; fill the kettle again with water, and let it boil for  $\frac{1}{4}$  of an hour, and having wrung the silk out of the first liquor and hung it on sticks, prepare a stronger than the first, in this you dip your silk so long till the colour is to your mind.

*Another Method.*

**P**UT into a clean copper or kettle to each pound of silk, two pound of fustic, let it boil for an hour, then put in six ounces of gall, let it boil together  $\frac{1}{4}$  an hour longer; the silk being allum'd and rinc'd, is turn'd about in this colour, then take it out of the kettle, and wring it out; dip it in pot-ash-lee, and wring it out again; then put it into the copper, let it soak a whole night, and in the morning rinse, beat it out, and hang it up to dry.

*Of dying Silk &c. of different Greens.*

**T**HE middling colour of blue and yellow produces a light green, grass green, laurel green, sea-green, &c. All olive-colours, from the deepest to the lightest are nothing else but green colours, which by walnut-tree root; fustic or foot of the chimneys, are chang'd to what shade you please.

*A fine Green for dying Silk.*

**T**AKE to one pound of silk  $\frac{1}{4}$  of a pound of allum, two ounces of white tartar, put them together in hot water to dissolve, and when so, put in your silk and let it soak all night, take it out the next morning, and hang it up to dry; then take one pound of fustic, boil it in four gallons of water; for an hour long, take out the fustic, fling it away, and put into the copper  $\frac{1}{2}$  an ounce of fine beaten verdigrease, stir it about for  $\frac{1}{4}$  of an hour, draw it off into a tub, and let it

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it cool, then put into that colour one ounce of pot-ashes, stir it together with a stick, dip into it your silk, so long till you think it yellow enough, then rince it in fair water and hang it up to dry; then dip it in the blue vat, till you think it enough; rince it again and beat it over the pin, and hang it up to dry; thus you may change the shades of your green by dipping either more or less, in the blue or yellow.

For the green, take to one pound of silk three ounces of verdigrease, beaten to a fine powder, infuse it in a pint of wine vinegar for a night, then put it before the fire, when hot stir it with a stick, and keep it from boiling; in this put your silk two or three hours, or if you would have it of a light colour, let it soak but for  $\frac{1}{2}$  an hour, then take scalding hot water, and in a trough, rub'd over with *Newcastle* soap, beat and work it up to a clear lather, in this rince your silk, then hang it up to dry; rince it again in river-water, beat it well, and when it is well clean'd, and dry'd, dress it.

*How to dye Linnen of a Green Colour.*

**S**OAK your linnen over night, in strong allum water, then take it out to dry; take woad, boil it for an hour long; take out the woad, and put in one ounce of powder'd verdigrease, or according to the quantity you have to dye, more or less; stir it together with the linnen, briskly about; then put in a piece of pot-ash, the bigness of an hen's egg, and you will have your linnen of a yellow colour, which when dry'd a little, being put into a blue vat, will turn green.

*To dye Yarn of a Yellow Colour.*

**I**N a copper of strong lee put a bundle of woad, and let it boil, then pour off the lee and take to one yard and a half of yarn, half an ounce of verdigrease, half an ounce of allum, put it into a quart of brown brasil-wood liquor, boil'd with lee, stir it well together and pour it in and mix it with the woad-lee; in this soak your yarn over night and it will be of a good yellow.

*To dye Green Tarn or Linnen Black.*

**T**AKE a sharp lee, put in three pound of brown brasil, and let it boil for some time, then pour off the colour from the chips, into a tub, add to it one ounce of gum arabick, one ounce of allum, one ounce of verdigrease; in this lay your yarn or linnen to soak over night, and it will be of a good black.

*To dye Silk an Orange Colour.*

**A**FTER you have clean'd your kettle well, fill it with clean rain-water, and take to each pound of silk four ounces of pot-ashes, and four ounces of orlean, sift it through a sieve into the kettle; when it is well melted, and you have taken care not to let any of those ingredients stick about the kettle, then put in your silk, which before you have prepared and allum'd as has been directed; turn it round on the winch and let it boil up, then take and wring it out, beat it and rince it; then prepare another kettle, and take to each pound of silk twelve ounces of gall-nuts, let the gall-nuts boil for two hours, then cool for the same space of time; after which put in the silk for three or four hours, then wring it out, rince, beat and dry it.

*Another Orange Colour.*

**S**OAK the white silk in allum water like as you do in dying of yellow; then take two ounces of orleans yellow, put it over night in water together with one ounce of pot-ashes: boil it up, add to it, after it has boil'd half an hour, one ounce of powdered curcumi, stir it with a stick, and after a little while put your allum'd silk into it for two or three hours, according to what height you would have your colour; then rince it out in clear soap-suds, till it looks clear, afterwards clear it in fair water, and dress it according to art.

*A fine*

*A fine Brimstone Yellow for Worsted.*

**T**AKE three pound of allum; one pound of tartar; three ounces of salt; boil the cloth with these materials for one hour; then pour off that water, and pour fresh into the kettle, make a lee of shart and pot-ashes, let it boil well, and then turn the cloth twice or thrice quickly through upon the winch, and it will have a fine brimstone colour.

*A Lemon Colour.*

**T**AKE three pound of allum, three ounces of ceruse, three ounces of arsenic, with these ingredients boil the cloth for an hour and a half; then pour off that water and make a lee of 16 pound of yellow flowers, three ounces of curcumi; then draw or winch your cloth through quickly, and you will have it of a fine lemon colour.

*To dye an Olive-Colour.*

**T**O dye this colour observe the first directions for dying a brimstone-colour; then make a lee of gall-nuts and vitriol, but not too strong; draw your stuff quickly thro', three or four times, according as you would have it, either deeper or lighter.

*To dye a Gold Colour.*

**H**AVING first dy'd your silk, worsted, cotton or linnen of a yellow colour, then take to each pound of the commodity, one ounce of fiset-wood or yellow chips, and of pot-ashes the quantity of a bean, boil this for half an hour, then put in your silk, and turn it so long, till the colour is to your liking.

*The Dutch Manner of dying Scarlet.*

**B**OIL the cloth in allum, tartar, salgemma, aquafortis, and pea-flowers, either in a pewter kettle or with aquafortis, in which pewter is dissolv'd; then put into the same kettle, starch, tartar and cochineel finely powdered, stirring or turning the cloth well about, and thus you may, by adding  
more



more or less cochineel, raise the colour to what height you please.

*General Observations for dying Cloth of a Red or Scarlet Colour.*

1. **T**HE cloth must be well soak'd in a lee made of allum and tartar, this is commonly done with two parts of allum and one part of tartar.

2. For strengthening the red colour, you prepare a water of bran or starch; the bran-water is thus prepared; take five or six quarts of wheaten bran, boil it over a slow fire in rain-water for a quarter of an hour, and then put it with some cold water into a small vessel, mixing it up with a handful of leaven, the sowerer it's made, the better it is; this causes the water to be soft, and the cloth to become mellow; it is commonly used in the first boiling, and mixt with the allum-water.

3. *Agaric*, is an ingredient used in dying of reds, but few dyers can give any reason for its virtue, but as it is of a dry spongy nature, it may reasonably be supposed, that it contracts the greasiness which might happen to be in the dye.

4. The use of arsenic is not a very necessary, but a very dangerous ingredient; aquafortis, or spirit of salt will supply its place as well.

5. To give a true description of scarlet, it is nothing else but a sort of crimson colour, the aqua fortis is the chief ingredient for the change thereof; this may be try'd in a wine glass, wherein a deep crimson colour may, by adding drops of aqua fortis to it, be changed into a scarlet, or to a perfect yellow.

6. Observe that you always take one part of tartar to two part of allum; most dyers prefer the white before the red tartar, but however, in crimson colours and others that turn upon the brown, the red tartar is chose by many as preferable to the white.

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*To dye Scarlet Cloth.*

**F**IRST take to one pound of cloth, one part of bran-water, and two parts of rain-water; then put into it two ounces of allum and one ounce of tartar, when it boils and froths, scum it, and put in the cloth, turn it therein for an hour, then take it out and rince it.

*To dye Cloth of a common Red.*

**T**AKE to twenty yards of cloth, three pound of allum, one pound and a half of tartar, and one third of a pound of chalk; put them in a copper with water, and boil them; then take six pound of good madder, and a wine-glass full of vinegar; let it be warmed together, and put in the cloth, turn it round upon the winch, 'till you observe it red enough; then rince it out, and it will be of a fine red.

*Another Method.*

**T**AKE four pound of allum, two pound of tartar, four ounces of white lead, and half a bushel of wheat bran; put these ingredients, together with the cloth, into a copper; let it boil for an hour and half, and leave it therein to soak all night; then rince it, and take for the dye, one pound of good madder, two ounces of orlean, one ounce and a half of curcumi, and two ounces of aqua fortis; boil them, turn the cloth with a winch for three quarters of an hour, and it will be of a good red.

*To dye Scarlet.*

**T**AKE to two pound of goud, two ounces of tartar, and one ounce of sal armoniac; grind them fine, and boil them up in fair water; add to them two ounces of starch, half an ounce of gum cotta, and one ounce of cochineel; when these are boiling hot, put in an ounce and half of aqua fortis, and let it boil; then take it out, and when cool rince it.

*To dye Brown Colours.*

**B**ROWN colours are produced from the root, bark, and leaves of walnut-trees, as also of walnut-shells; china root might also be used for brown colours; but it being of a disagreeable scent, it should only be used for hair colours in stuffs, for which and the olive colours it is of more use: The best browns are dy'd with woad and walnut-tree root.

*A Nutmeg Colour on Stuffs.*

**T**AKE three pound of allum, half a pound of tartar, put this into a copper of water, and boil your stuff for an hour and a half; and take it out to cool. Then take one pound and a half of fiset-wood or yellow flowers, three pound of madder, one pound of gall-nuts; put it together with the stuff, into a copper, boil and turn it with a winch, till it is red enough, and take it out to cool; then take two pound of vitriol, which before is dissolv'd in warm water, put it in the copper, and turn the stuff till the colour is to your mind; then rince it out.

*Or,*

Take half a bushel of green walnut-shells, or else walnut tree-root, infuse it in a kettle, and when it begins to boil put in the stuff over a winch, turn it about three or four times, then take it out and let it cool; after it is cold, boil the liquor again, and put the stuff in, turn it for half an hour, and take it out and let it cool; then put in one pound of gall-nuts, three pound of madder, together with the stuffs into the kettle, let it boil for an hour; take it out and let it cool again; take one pound of vitriol, put it in, stir it well about, then put in again the stuffs over the winch, turn and boil it so long till you perceive your colour deep enough; then take it out and rince it.

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*How to make Flax soft and mellow.*

**M**AKE a strong lee of wood or pot-ashes, and unslack'd lime, in which soak your flax for 24 hours; then put it together with the lee into a copper, and let it boil, and it will be as soft as silk. After this rince it in clean water; wring out the water, and put the flax again into a strong lee; repeat this thrice, then rince it out, dry it, and it will answer your purpose. Some prefer cow-dung, with which the flax is daubed all over, or soak it in a lee of cow-dung for 24 hours, then rince and dry it.

*An excellent Water for taking out Spots in Cloth, Stuff, &c.*

**T**AKE two pound of spring water, put in it a little pot-ashes, about the quantity of a walnut, and a lemon cut in small slices; mix this well together, and let it stand for 24 hours in the sun, then strain it through a cloth, and put the clear liquid up for use; this water takes out all spots, whether pitch, greafe or oil, as well in hats, as cloath, stuffs, silk, cotton and linnen, immediately; but as soon as the spot is taken off, wash the place with water, and when dry you will see nothing.

*To Dye Woolen Stuffs of a Black Colour.*

**F**INE cloaths and such stuffs as will bear the price must be first dy'd of a deep blue in a fresh vat of pure indigo; after which you boil the stuffs in allum and tartar; then you dye it in madder, and at last with galls of *Aleppo*, vitriol and *Sumach Arab.* \* dye it black; to prevent the colour soiling when the cloaths are made up, they must, before they are sent to the dye-house, be well scowered in a scowring-mill.

Middling stuffs, after they have been prepar'd by scowring and drawn through a blue vat, are dy'd black with gall-nuts and vitriol.

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\* Is a shrub that grows in *Spain*, *Portugal* and *France*, from which countries it is carried in abundance to most parts of *Europe*: that which is good must be dry and of a light green colour, that of a brown hue is spent and good for little. It is used by black dyers, cordwainers &c. The eaves boil'd in lee, dye hair black;



For ordinary wool or woollen stuffs take walnut tree branches and shells, a sufficient quantity; with this boil your stuff to a brown colour, then draw it through the black dye made with the bark of elder, iron, or copper filings, and indian-wood.

*To Dye Linnen of a Black Colour.*

**T**AKE filings of iron, wash them, and add to them the bark of an eldertree; boil them up together, and dip your linnen therein.

*To Dye Woollen of a good Black.*

1. **T**AKE two pound of gall-nuts, two pound of the bark of elder-tree, one pound and a half of yellow chips, boil them for three hours; then put in your stuff, turn it well with the winch, and when you perceive it black enough take it out and cool it.

2. Take one ounce and a half of sal-armoniac, with this boil your stuff gently for an hour long, turning it all the while with the winch: then take it out again and let it cool.

3. Take two pound and a half of vitriol, a quarter of a pound of *Sumach*; boil your stuff therein for an hour; then cool and rince it, and it will be of a good black.

*Another Black Colour for Woollen.*

**F**OR the first boiling take two pound of gall-nuts, half a pound of brasil-wood, two pound and a half of madder; boil your cloth with these ingredients for three hours, then take it out to cool; for the second boiling take one ounce and a half of sal-armoniac, and for the third two ounces and a half of vitriol, three quarters of a pound of brasil, and a quarter of a pound of tallow.

*Another*

*Another Black Colour for Plush.*

**P**UT the following ingredients into a large vessel, *viz.* eight pound of elder bark, eight pound of *Sumach*, twelve pound of oaken chips, nine pound of vitriol, two pound of wild marjorum, six pound of tile-dust, some waste of a grind stone, six pound of walnut-leaves, half a pound of burnt tartar, two pound of salt, four pound of woad; on these pour boiling water till your vessel is full; your plush after it is well boil'd and cleansed must be well galled, and this you do by boiling it in one pound and a half of *Sumach*, eight ounces of madder, two ounces and a half of burnt saltpetre, half an ounce of sal-armoniac, one ounce and a half of vitriol, half an ounce of burnt tartar; then take it out, and let it dry without rinceing it.

Then you fill the copper with the above liquor, and boil and dye your plush in the manner as you do other stuffs, turning it round with the winch: when the colour is to your mind, take out the plush, let it cool, and then rince and hang it up to dry.

*To Dye Silk of a good Black.*

**I**N a copper containing six pails of water, put two pound of beaten gall-nuts, four pound of *Sumach*, a quarter of a pound of madder, half a pound of antimony finely powdered, four ox-galls, four ounces of gum tragacant first dissolv'd in fair water, of fine beaten elder-bark of two ounces, and one ounce and a half of iron file-dust; put these ingredients into the above water, and let them boil for two hours, then fill it up with a pail full of barley-water, and let it boil for an hour longer, then put in your silk, and boil it for half an hour slowly; then take it out and rince it in a tub with clean water, and pour that again into the copper; the silk you rince quite clean in a running water, then hang it up, and when it is dry, put it in the copper again, boil it slowly for half an hour as before, then rince it in a tub, and again in rain water; when dry, take good lee, put into it two ounces of pot-ashes, and when they are dissolv'd, rince the silk therein

quickly, then in running water, this done, hang it to dry and order it as you do other colour'd silks.

This colour will also dye all sorts of manufactur'd wool-len stuffs.

To give the black silk a fine gloss, you must, before the last dipping, put in for each pound one ounce of isinglass, first dissolv'd in water.

*Another manner for dying Silk.*

**I**N a copper of three pails of water put two ounces of borax, half a pound of *Agaricum*, a quarter of a pound of litharge of silver, four ounces of madder, one quartern of brandy, four ounces of verdigrease; let them boil together for an hour, then cover the copper and let the liquid rest for 14 days: when you design to use it, take two pound of *Senne*s leaves, two pound of *Gentian*, one pound of *Agarica*, two pound of granat shells; let them boil together for two hours, and then put it to the other liquor settled in the copper: this colour will keep good for many years, and the longer you dye therein, the better it will grow, you must be careful to keep it free from soap, which would spoil it so as not to be recover'd by any means; and in case by accident some tallow should happen to drop from your candle into it, then forbear meddling with it 'till it is cold, when so, take it off carefully; or heat your poker red hot and sweep it over the surface, this will take off all the greasiness: then take two or three little bags of canvas, fill'd with bran, hang them in the colour for two or three hours whilst the copper is heating, then clap whited brown paper on the surface of the colour, which will take off all the greasiness that might remain, after that begin to dye.

Your silk that is to be dyed must be first boil'd in bran, then gall'd; to each pound of silk take twelve ounces of gall-nuts; boil the gall-nuts for two hours, before you put the silk into it, which must soak therein for 30 hours.

*To Dye a Gray Colour.*

**G**R A Y is a middle colour, between black and white, which beginning with a white gray, approaches by degrees to a black gray: it may be observed, that if the black colour was to be prepared only of gall-nuts and vitriol, it would procure but an indifferent gray, but if to these ordinary ingredients for dying of stuffs, you add some indian-wood, you may procure white gray, pearl colour, lead colour, whitish gray, iron gray, black gray, brown gray, &c. Some of these colours require a little tincture of the woad.

*To Dye a Brown-red Colour either on Silk or Worsted.*

**F**IRST, after you have prepar'd your silk or worsted in the manner directed for dying of red colours, boil it in madder, then slacken the fire under the copper, and add to the madder liquor some black colour, prepared as has been shewn, then stir the fire, and when the dye is hot, work the commodities you have to dye therein, till you see them dark enough.

But the best way to dye this colour is in a blue vat, therefore chuse one either lighter or darker, according as you would have your colour; then allum and rince your silk in fair water, this done, work it in the copper with madder, till you find it answer your purpose.

*Another.*

**P**UT into a kettle of hot water a handful of madder, stir it together, and let it stand a little: then take the woollen stuff, wet it first, then let it run over the winch into the kettle, turning it constantly; if you see it does not make the colour high enough, add a handful more of madder, rincing the stuff or silk sometimes to see whether it is to your liking.

Then put some black colour into the kettle, mix it well together, stir the fire, and when hot, turn your silks or stuffs with the winch, and dye it either of a blacker hue by adding more black, or a redder by putting in less.



*Of Madder and its Usefulness in Dying of Silk, Worsted, Cotton, &c.*

**M**ADDER is a red colour, the best grows in *Holland*, though the colour of that which grows in *Flanders* exceeds it; each sort of madder is mark'd with a particular mark, to know what country it comes from. The only sign of the real goodness of madder, is the bright colour, which when being ground to a fine powder, and put on a blue or brown paper, sticks to it: it must be kept close from the air, otherwise it will loose the strength, and beauty of its colour.

The madder which comes from *Silesia*, under the name of *Breslaw* red, resembles more a red earth than a root, it has not so bright a colour as that which comes from *Holland*: to manure and cultivate the ground for the growth of madder, it must be observed, that it requires a good mould, which is neither too damp nor dry, it must be plow'd pretty deep, and be well dung'd before the winter season. It is sown in the month of *March* in the decrease of the moon, after the land in which it is to be sown, is well clear'd of weeds, least they should attract the strength and goodness thereof to themselves, and their roots mix with the madder.

About eight months after the madder is sown, they begin to pull up the larger roots thereof, which is done to hinder it from drawing the strength from the earth to themselves, which are to be a nourishment for the younger sprouts; this is commonly done in the month of *September*, when the seed is ripe for gathering. The remaining roots are then well covered with mould, till the next year, when the larger roots are again gathered; thus it is managed 8 or 10 years together, after which the spot of ground may be cultivated for the growth of corn, and a new plantation fix'd upon in another place.

The roots of madder which grow in *Flanders* and *Zealand*, when pull'd out are dry'd in the sun; but in hot countries they are dry'd in shady places, in order to preserve their colour and strength; after that they are ground in mills to a powder, and pack'd up close in double bags.

The

The fresh madder yields a lively colour, that of a year old a more lively one; but after that time the older it is, the more it loses both its strength and beauty.

*Concerning the Dying with Madder.*

**I**T has been a common rule to take to eight pound of madder, one pound of tartar; allum and tartar are used for preparing the commodities to be dy'd, for attracting and preserving the colour.

Pot-ashes heightens the colour very much, as does bran-water; brandy is of peculiar use; it attracts the colour, makes it look clear and fine, and frees the subtillest particles from its dregs and impurities. Some dyers, and indeed most, ascribe the same virtue to urine; but this is false, and although it may be of some use when fresh, it is highly prejudicial to light colours when stale, for it expels its particles of salt too much, and causes the colour to be of a heavy and unpleasant hue: this ought therefore to be a caution to such as would dye light and tender colours. The experiment may be tryed in a glass of clean water, in which latmus, being first dissolved and filtered, is poured in; if to this liquid, which is blue, you pour some spirit of salt, it will turn red, and mixing it with some dissolved salt of tartar it will resume its former colour; if you pour too much of the latter, the liquid will turn green, and thus you may change the colour by adding more or less of either the one or the other ingredient to it.

*To dye Silk of a Madder Red.*

**P**REPARE it as has been directed under the article of dying silk of a crimson colour. This done put a pail full of river-water into a copper, together with half a pound of madder; boil it for an hour, and take care it boils not over; then let it run off clear into another vessel, stirring into it one ounce of curcumi; then put in your silk, let it lay therein till cold, then wring it out and beat it; this done take half a pound of good brasil-wood, boil it in bran-water for an hour, clear it off in another vessel, and put in your silk; since

it out in soap-lee, and then in running water; after which dry and dress it.

*Another Method.*

**A**FTER you have prepared your silk for dying, hang it on sticks, and to each pound of silk, take eleven pound of madder, and four ounces of nut-galls; put these into a copper with clean rain-water, hang in your silk, and augment the heat of the copper till it is ready to boil; then turn your silk in it for half an hour, and prevent its boiling by lessening the fire; after this rince and beat it out, hang it again on sticks, in a tub with cold water, in which before you have put some pot-ashes; this gives it a beauty; then rince and dry it. How this madder is made use of for dying of worsteds or stuffs has been shewn already.

*Of Cochineel and its Usefulness in Dying.*

**C**ochineel, a costly fine red and purple-colour, are small dry'd up insects, in size of bed-bugs, which when brought into a powder and boiled, do yield a beautiful red juice or colour, and are used very much by scarlet dyers, for dying of silks, worsteds, cottons, &c. They are gathered in abundance in the *Spanish West Indies*, where they harbour on a certain tree, called the prickle-pear-tree; the leaves are of a slimy nature, and the fruit of a blood-red colour, full of seeds: the insect feeding on this fruit is ingendred with the tincture thereof. The *Indians* spreading a cloth under those trees, shake them, and by this means catch the insect, where they soon dye. This is the manner of preparing cochineel.

*Of Kermes, and its Use in Dying.*

**T**HIS grain, by some called scarlet berry, on account of its containing that choice and noble colour, scarlet, grows in *Poland* and *Bohemia*, on small shrubs; they are about the bigness of a pepper-corn; the best comes from *Spain*: it is also found in *France*, especially in *Languedoc*, and is gathered in the latter end of *May*, and the beginning of *June*.

*June.* In *Germany* these berries are among the vulgar call'd *St. John's Blood*, because of their being found on the shrubs about *Midsummer*, or the feast of *St. John the Baptist*.

The *Poles* call it purple-grains; they grow very plentifully in that country, and that people first discovered its virtue for dying of crimson and purple, by a hen picking those berries, and discharging her excrements of a crimson colour. The district about *Warsaw* affords great quantities. In the *Ukrain* they are still in more plenty; and on the borders of the sandy deserts of *Arabia*, they are gathered with great pains by the poor people, whence, it is thought, they retain the *Arabian* name of *Kermis*: those berries or grains, when ripe, contain an insect of a crimson red, which, if not timely gathered, will disengage itself from the shell and fly away; wherefore the people watch carefully the time for gathering, when they roll them together in their hands into balls, dry and sell them to the *European* and *Turkish* merchants, who furnish therewith the colour dyers. The *Dutch* mix it among the cochineel, because it causes that colour to have a higher and finer hue.

### Of Indigo.

**I**NDIGO is a dry and hard blue colour, which is brought to us in lumps of different pieces or sizes; it is an *Indian* shrub, which at certain times of the year, when in blossom, is cut down and laid in heaps, so long till it is rotten; then the *Indians* carry it to the mills, which are built in great numbers about that place, where it is ground, boil'd and press'd, and when it is dry'd, they cut it in pieces, pack it in chests, and send it abroad.

There are several different sorts of indigo *viz.* indigo *Guatemala* and indigo *Lauro*, both which are exceeding good and fine; their goodness is known when in breaking it appears of a high blue, and not sandy; however that with a deep gloss is not amiss. These two sorts are followed by these, *Plato*, *Xerquies* and *Domingo*, which are counted not so good as the former. The *Indigo Plato* and *Xerquies*, are of a high violet colour, and very light in weight, so as to swim on the water; these are by some reckoned better than that of *Gautimala*, because it is press'd only



only from the leaves, and the other from the stalks and leaves together. *Indigo Domingo* is not of so lively a copper colour as the former, and is much mix'd with sand and earth; the merchants try this sort by lighting a piece, the good sort will burn like wax, and leave all the dross behind.

*Curcumi*

**I**S a foreign root in the shape of ginger, of a saffron colour; it is brought to us from the *Indies*, where it is made use of both for dyers and spice.

It is also call'd the *Indian* crocus, the best is that which is heavy and in large pieces, without dust: there is no fitter ingredient to be found for heightening the scarlet to a yellow hue, and it is frequently used by colour dyers in tempering their reds, be they dy'd with kermes, cochineel, or madder; aqua fortis will do the same, but adds a greater life, especially to scarlet.

*Camphir or Brasil-wood.*

**T**HIS comes from the country of *Brasil* in the *West-Indies*, it is cut out of a tree call'd by the inhabitants *Arbontan*; which, with its stem and branches is not much unlike an oak-tree, only thicker, some will measure 24 foot round the stem; the leaves resemble those of box-tree: the finest brasil-wood is cut about *Fernambuca*, a town in the country of *Brasil*, this exceeds in colour all the other kinds of brasil-wood, and is therefore sold at a dearer rate: this wood produces in dying of silks, &c. a fine colour, but it is very fading. It is best for black-dyers, who by using it with gall-nuts, *Sumach*, *Rodoul*, *Fovic*, vitriol, and verdigrease, dye a good black or gray therewith.

*Orchal.*

**O**RCHAL is prepared from a small moss which grows on rocks and cliffs, the chief ingredients for its preparation are chalk and urine, and although the colour it produces

duces in dying of silks &c. is fading, yet whilst fresh, it is exceeding beautiful.

*Orlean*

**C**OMES from the *West-Indies*, either in square pieces like *Newcastle* soap, or in round lumps, or small cakes, the bigness of a crown, which last is reckoned to be the finest sort, and has a fragrant smell of violets; it is a tincture press'd from a seed, and when dry'd, of a dark red yellow colour. The druggists sell two sorts of orlean, the one is like a dough and is very cheap, the other is dry and very valuable. The dyers use it for dying of brown-yellows, orange-colours, &c.

*Gall-nuts*

**I**S a fruit of various sorts, some are small, others large, black and white, smooth and knotty; they grow on high oak-trees, and by merchants are imported from *Smyrna*, *Tripoly*, *Turky*, and *Aleppo*; the heaviest is counted the best, especially when black and knotty.





## P A R T II.

## Of Artificial FIRE-WORKS.

**H**AVING in the preceding seventh part of the *Laboratory*, already given a sufficient account not only concerning the nature and property, but also the management of saltpetre, in promoting of its growth, in cleansing and refining the same, &c. it would be needless here to enlarge upon that subject, except it were of such things that have there been omitted, and are of use in the management of artificial fire-works.

*How to boil Saltpetre to a Powder.*

**T**AKE a clean kettle or pan, put in as much saltpetre, as to lay at least two fingersthick; pour on it so much water as will just cover it; put it on a slow fire, and when the saltpetre is dissolved, take off the impurities with a skimmer, and let it boil gently till it begins to thicken, keep it stirring continually, till it is turned to a white sand or flower; then take off the kettle, and pour out the saltpetre on a table or board, spreading it thin, to cool.

*How to melt Saltpetre.*

**P**UT a crucible with saltpetre on charcoal; when melted, take off the scum carefully; then sling a little piece of brimstone upon it, and when that is burnt, pour the melted saltpetre on a clean metal plate or stone, and it will be of a fine white colour, transparent and like alabaster.

*N. B.* To one pound of saltpetre, take half an ounce of brimstone.

of

*Of Sulphur or Brimstone.*

**S**ULPHUR is by nature the food of fire; it is the principal ingredient in gun-powder, and all sorts of fire-works. Among brimstone, that which is of a high yellow, and which when held in ones hand, crackles and bounces, is the best.

*How to strengthen Brimstone.*

**M**ELT as much of the clearest brimstone as you will, in a kettle or other utensil, and when the greatest heat is over, then put into it, for each pound of brimstone, half an ounce of quicksilver, stir them well together, till the quicksilver and brimstone are united, then pour it out into brandy; instead of quicksilver, you may use the same quantity of zinnaber, and it will do as well.

*How to break or granulate the Brimstone.*

**T**AKE some spirits, put a handful of brimstone therein and let it dissolve; then take a broad stick, and stir it about till it grows mealy, and runs like sand. If you would have it strong and hard, sling a handful of saltpetre into it.

*How to prepare the Oil of Saltpetre.*

**P**UT some good refined saltpetre upon a dry and well plained deal-board, underneath which place a copper bason, round about make a coal fire, and the heat thereof will draw the saltpetre, changed into an oil, through the board, and it will drop into the bason: this you may continue as long as you will, by recruiting the board with fresh saltpetre.



*To prepare Oil of Sulphur.*

**F**ILL a matrafs with fine pulverized brimstone about one third full; on this pour as much nut or elder oil as will fill the matrafs half full, set it in warm ashes, and let it stand for 8 or 9 hours; and the oil will change the brimstone to a fiery red oil.

*To make Sal-armoniac Water.*

**T**AKE three ounces of sal-armoniac, one dram of salt-petre, pulverize it fine, and mix it together; then put it into a matrafs, pour on it strong vinegar, and distil it over a slow fire; then dry and refine it.

*To make Camphir and the Oil thereof.*

**T**AKE of pulveriz'd juniper-gum two pound, and of distill'd vinegar enough to cover it, put them together into a glass phial; set it for 20 days in warm horse dung, then take it out again, and pour it out into another glass, with a wide mouth to it, expose it to the sun for a month, and you will have a concreted camphir, like a crust of bread, which is in some measure like the natural camphir: this, for use in fire works, is wrought to a powder by grinding it with sulphur in a mortar.

The oil of camphir which answers the same end is produced by adding a little oil of sweet almonds, and working it together in a brass mortar and a pestle of the same metal, thus it will turn into a green oil.

*How to prepare Oil of Brimstone and Saltpetre at once together.*

**T**AKE brimstone and salt-petre an equal quantity of each, mix them together, grind them to a fine powder, sift them through a fine sieve; then put it into a new earthen pot, pouring as much sharp vinegar or brandy to it as is sufficient to cover it; then lute up your pot close, so as to prevent

vent any air entring into it, set it in a warm place, till the vinegar or brandy is quite digested, then take the remains, and extract it in a chymical manner.

*To prepare Charcoal for Fire-works.*

**C**OALS are a preservative, whereby the fire, which by the brimstone is brought into gun-powder, may not suffocate the strong and windy exhalation of the saltpetre.

The charcoals are of several sorts; some prefer those burnt of hazle and willow wood; when you go to burn them, split the wood about one foot long, in four equal parts, scale off the bark, separate the pith and hard knots; dry them in the sun or in a baker's oven; then make in the earth a square hole, line it with bricks and lay the split wood therein, crossing one another, and set it on fire; when thoroughly lighted and in a flame, cover the hole with boards and fling earth over it close, to prevent the air from coming thereto, yet so as not to fall among the coals; having lain thus for 24 hours, take them out and lay them carefully up for use.

*To make the Moulds for Rockets.*

**T**HE rockets bearing the pre-eminence, and being the principle things belonging to a fire-work, it is requisite to give some definition of every part of them, how they are made, finish'd and fired: in order to do this, I shall first endeavour to give the curious some idea concerning the moulds they are formed in, these are turn'd commonly of close and hard wood, as of whtie plumb-tree, box, chefnut, cypress, juniper, *Indian wood*, &c.

Some also are made of ivory, and for rockets of extraordinary large sizes, they are cast in brass or copper, and turn'd the inside in a nice manner, the foot or basis with its cylinder, wart or half bullet may in these as in others remain of solid wood. The whole is commonly turn'd in the size and form of a column in architecture, and embellish'd with ornaments, according as you fancy.

The

The order to be observed in the size of the cylinder, it is agreed by the most famous artificers, that the moulds of all rockets from a half to six pound, ought to be six diameters; but the larger size of four, four and a half, or five diameters of their orifices high.

Those rockets which go under the denomination of small ones, are those whose inward diameter cannot receive a ball that exceeds one pound. The middling sort are those whose diameter can admit balls of one, two or three pound; and great ones are such, whose bore will receive balls from three to a hundred pound.

Rocket moulds from some ounces to three pound, are ordinarily seven diameters of their bore long, the foot two or three diameters thick, the wart two thirds of the diameter, and the piercer one third of the bore, the roller two thirds, and always one or two diameters from the handle longer than the mould; the rammer one diameter shorter than the mould, and somewhat thinner than the roller, to prevent the sacking of the paper when the charge is ramm'd in, having always one still shorter, that when the shell of the rocket is ramm'd half full, you may use that with more ease. For the better illustration, see fig. 1. representing the mould with its bases, cylinder, bore and piercer. A B the interior diameter of the mould. C D the height of the mould, seven diameters; from D to E, is the height of the breech at bottom, which stops the mould when the rocket is driving, and this is one and  $\frac{1}{3}$  diameter. Upon this bottom you have a solid cylinder, whose height is one diameter of the orifice A B, this cylinder is crowned with a wart or half bullet I, having a hole in the center, in which is fixed the iron or copper piercer F. G an iron pin that keeps the bottom and cylinder together. 2. The rowler. 3. The rammer. 4. The shorter rammer.

It is to be observed, that some of these moulds are made 9 diameters of their orifice long, the shell therefore with the wart will be 12 diameters. These sorts of rockets fly very high, because of their length, they containing a greater charge than the short, nevertheless the piercer needs to be no longer than seven diameters, but substantial, so as to keep in its proper attitude; it will require the dimension of two thirds of the diameter at bottom, and from thence tapering to half the diameter,

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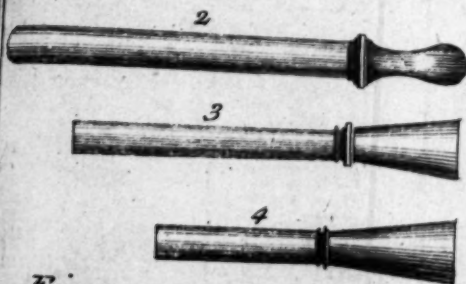
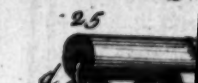
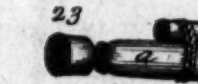
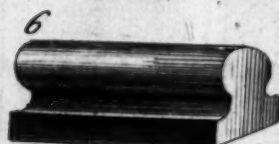
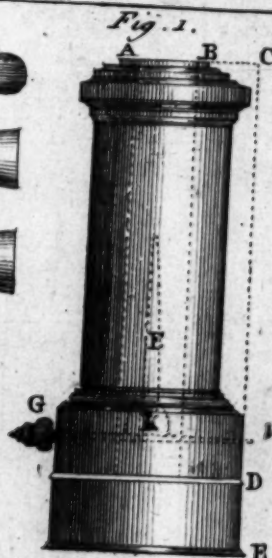
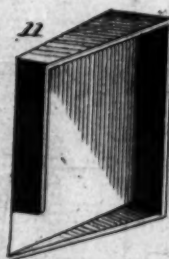
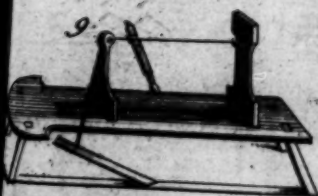
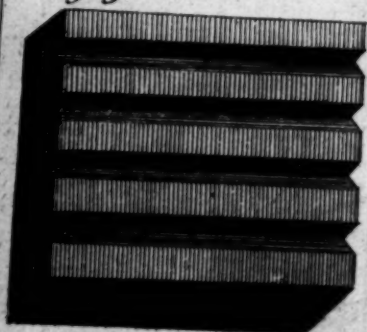
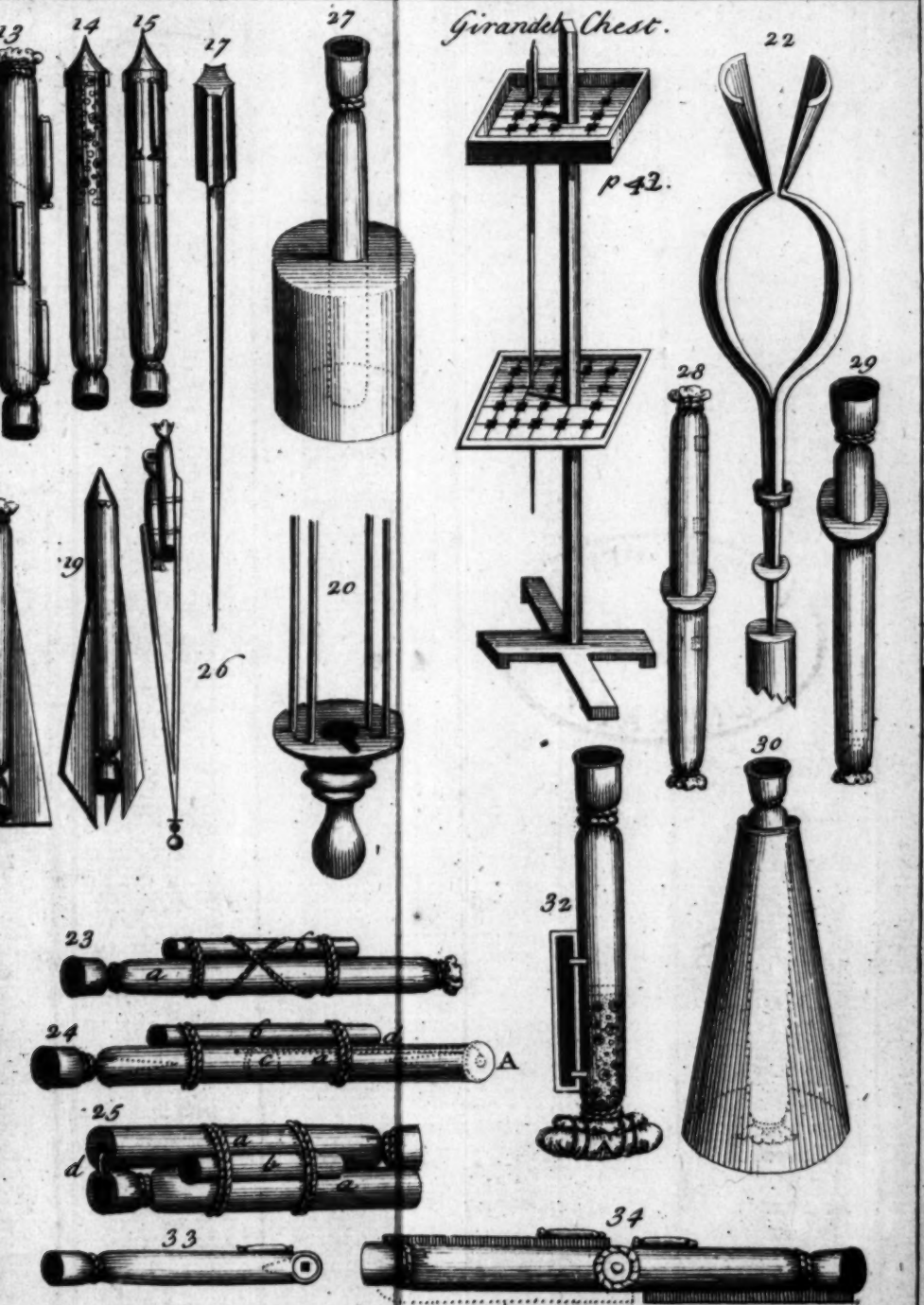


Fig. 5.





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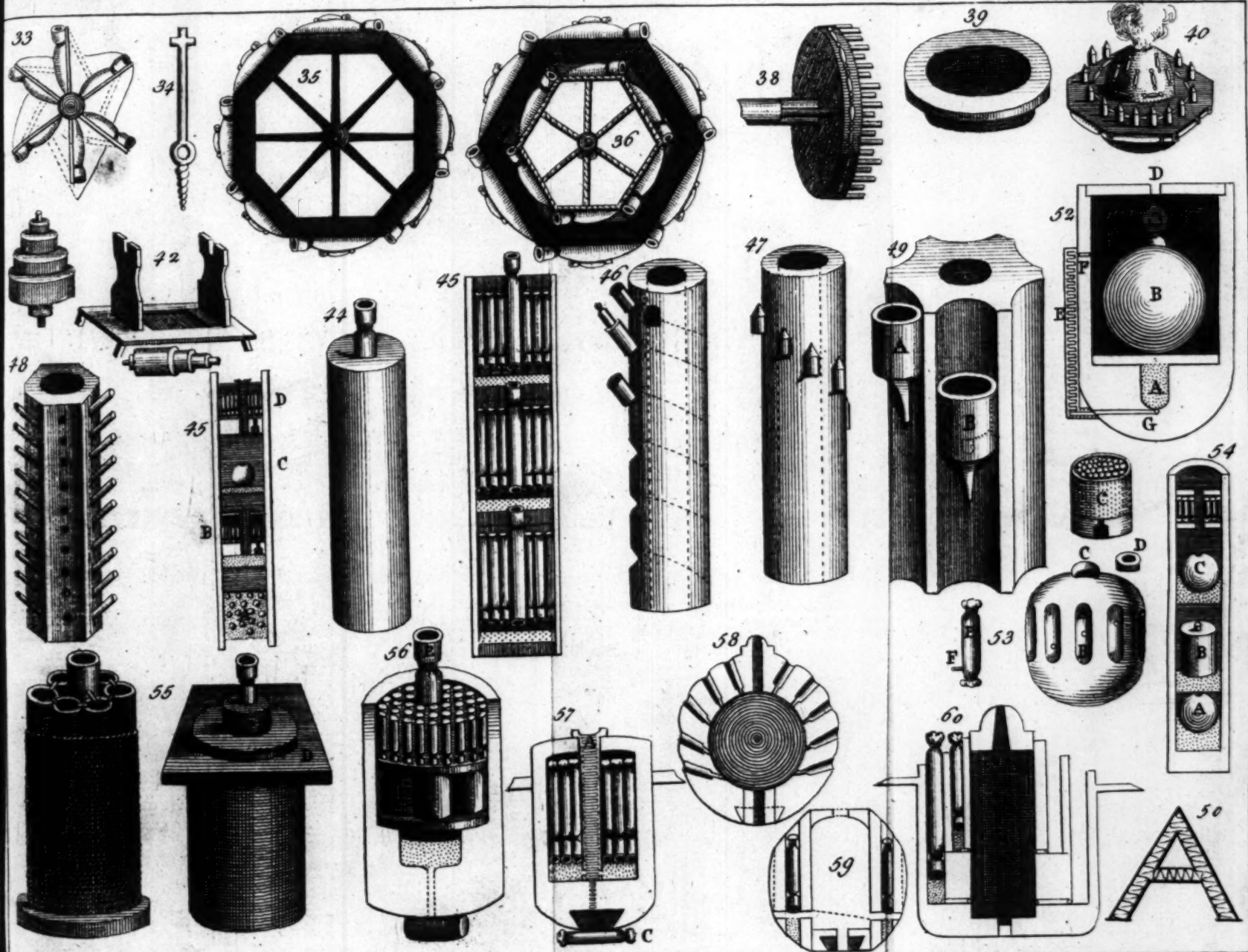


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G. Smith

# PLATE II.



G. Smith del.

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*Charges for Water-cats.*

**M**EAL-powder two parts, saltpetre four parts, brimstone one part, coarſe coals two parts, ſaw-duſt two parts, and antimony three parts, moiſten'd with linſeed oil.

Meal-powder two ounces and a half, ſaltpetre three ounces and a half, brimſtone two ounces and a half, and antimony half an ounce.

Meal-flower one pound, ſaltpetre two pound, brimſtone one pound, and charcoal one pound.

Saltpetre fifteen ounces, brimſtone five ounces, ſaw-duſt eight ounces, and antimony two ounces.

*Some general Remarks upon Rockets.*

1. **Y**OUR rockets muſt have their proportionable height, according to the diameters of their oriſices.
2. Their necks muſt be drawn or choak'd firm, and to prevent the cord giving way, they muſt be glued over.
3. Prepare your compoſition juſt before you want it.
4. Let it neither be too damp nor too dry, but ſprinkle it over with a little oily ſubſtance, or a little brandy.
5. When you drive your rockets, put always equal quantities of compoſition in your caſes at a time.
6. Carry with your mallet an even and perpendicular ſtroke, when you charge your rockets.
7. The cavity muſt be bored upright and perpendicular, exactly in the middle of the compoſition.
8. Bore your rockets juſt before you uſe them; then handle them carefully, leaſt their form ſhould be ſpoiled.

## An APPENDIX

9. Let the sticks and rods be well proportioned, strait and smooth.

10. Put your rockets, when compleated, in a place that is neither very damp nor dry.

11. Let most of your rockets have at top a conic figure, by that means they will the easier shoot through the air.

12. Avoid, if possible, a damp, foggy, rainy or windy night, to play your rockets.

*Defective Rockets are chiefly discovered by the following Observations.*

1. **W**HEN they are fired and in mounting two or three perches, they break and disperse without performing their proper effects.

2. When they remain suspended on the nail, and waste away slowly without rising at all.

3. When they form an arch in their ascent, or a semi-circle, and return to the ground before their composition is burnt out.

4. When they mount in a winding posture, without an uniform motion.

5. When they move on slowly and heavy.

6. When the cases remain on the nails, and the composition rises and disperses in the air.

More of these vexatious accidents will sometimes frustrate the hopes of a young practitioner, but as the above are the principal ones, he must endeavour to avoid them in his first beginning.

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*Of Rocket Flyers, and the manner of charging them.*

THESE are of two sorts, namely, the single and double, the latter are made after the following manner:

Have a nave or button turn'd, the dimension of three inches, together with two knots upon it, perpendicular one against the other, of an inch and an half long, and so thick that both rocket cases may fit over them; there must also be a hole of the third of an inch in the centre of the nave, for the iron pin to go through, on which it is to fly; after this take two rocket cases, of equal dimensions, which are choak'd quite close at the neck, and glewed: ram in the charge so far as to leave only room to fix them on the two knobs upon the nave: this done, bore into both rockets, near the closed up necks, small touch-holes, and one more near the pin, in that which is to burn first; from this hole, carry a little pipe to the hole near the neck of the other rocket, having first fill'd it with meal-powder, that when the rocket is almost burnt out, the second may be lighted by the first. The three touch-holes stand in one row, and you may on the other side fix a couple of reports, which will cause a swifter motion.

The single flyers are made with more ease, the neck in these must not be tied close as in the former, but they must be fired in that place; but these don't turn so well as those that are made double, the figures hereof will give you a fuller idea to manage them. See Fig. 33. 34.

*Of Fire-Wheels.*

OF these there are three sorts, viz. single, double, and triple; some of their fells are of a circular form, others an hexagon, octagon or decagon form, some like a star without fells; some, and the most of them, are made to run perpendicular to the earth; others horizontal; all may be ordered so as to serve either land or water.



The fire wheels that are to be used on land, turn upon an iron pin or bolt, drawn or screwed into a post. The nave is turn'd of close and firm wood, in which the joiners glew the spokes, according to the number of the fells, which must be carefully joined together; then have a groove hollowed round, so deep that the rocket or case may be about half lodg'd therein. See Fig. 35.

The double wheels must have their fells turn'd stronger and wider, with a groove for the rockets, not only at top, but also on one side thereof; plying the necks of the rockets at top to the right, and those of the sides to the left hand. Vid. Fig. 36.

A triple wheel has a groove at top, and one at each side; the matches are laid from one groove and rocket to another, with small pipes, fill'd with meal-powder: you may also make a triple wheel on a long nave, and observe the placing of the rockets on each, contrary one to the other; and the communication you are to make with small pipes, which, after they are fix'd, you are to cover and glew over with paper. Vid. Fig. 37.

Your rockets being ready and cut behind a little shelving, bore them; the first three diameters of its orifice, the second two and three quarters, the third two and a quarter, the fourth two diameters, the fifth one and three quarters, the sixth one and a half; the seventh one and a quarter; the eighth one diameter; always the latter something shorter than the preceeding; after this they are prim'd with meal-powder work'd up with brandy, and when dry, glew'd in the above describ'd grooves; you must bear the first fir'd rocket's neck up above the rest, underlaying it with a tin plate, or anything else, the same you must observe in the head of the last fired one, wherein you put the charge of a report; you may also glew on every end of the rockets, a report of paper, with small pipes of copper, or goose-quills, which are fix'd one end in the side of the rocket, and the other in the report. When all is dry, then you may cover your wheel on one or both sides, with linnen or paper, in what form you would have it.

The horizontal wheels, are made like the others with fells, or out of one entire piece; their grooves are furnished with

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with rockets, and their plane garnished with crackers. Vid. Plate I. Fig. 38.

A fire wheel which is to whirl horizontally in the water must be thus ordered.

Take a pretty large wooden dish or bowl, that has a broad flat rim, See Fig. 39. also a smooth dry board, something larger than the dish, and form'd into an octagon; in the middle of this board make a round hole, that will hold a water-ball, so that one half be received in the dish, and the other half rise above the surface of the board; nail this board upon the rim of the dish, and fix the ball in the middle, tying it fast with wire; then glw your rockets in the grooves which are made round the edges of the board, laying them close to one another, so that successively taking fire from one another, they may keep the wheel in an equal rotation. You may add, if you please, on each side of the wheel, a few boxes, fill'd with crackers or cartouches, erected perpendicular, and also fix double and single crackers, following in a range, one after another, for two or three fires, or as many as the extent of the wheel will admit.

For your private fuzees, observe that you conduct one from the rocket, which is to be fix'd to the composition of the ball in a channel.

Fill these channels with meal-powder, and cover them close with paper: also lay a train of fuzees of communication from the rockets to a cartouch, and from that to the rest. See Fig. 40.

Lastly, when all is ready and covered, dip the whole machine into melted pitch, and secure it from the injury of the water; the ball is fired first, and when lighted, you place it gently on the surface of the water, and then fire the rocket.

To try a fire-wheel, first weigh one of the rockets, tie it to a fell with cord, and according to that weight, fill little long bags full of sand, tying them likewise on the rest of the fells; then hang the wheel on an iron pin, fire the rocket, and if it turns the wheel, then you may assure your self it will be compleat when finish'd.

Wheels form'd like stars, are to have their spokes fix'd upright in the nave, like other wheels, only with grooves on one of the sides of each, wherein you glew the rockets, at the bottom of each rocket is made a little hole, from whence the fire is convey'd through little pipes, fill'd with meal-powder up to the next, and so round; then cover it with linnen cloth or paper in the shape of a star, and place it on the iron axis.

Observe that all the rockets used in fire-wheels, have their necks tied close, leaving only a small conveyance from one rocket to another; the last of all must be well secured below, where you may place a strong report of corn-powder. See Fig. 40.

*Charges for Fire-flyers and Wheels, of four, five, and six Ounce Rockets.*

**M**EAL powder three pound, saltpetre two pound, charcoal five ounces, and sea coal three ounces.

Meal powder fourteen ounces, saltpetre six ounces, charcoal three ounces and a half, brimstone three ounces, and sea-coal three ounces.

Meal powder fifteen ounces, saltpetre six ounces, brimstone three ounces, and charcoal three ounces.

Saltpetre five pound, brimstone three quarters of a pound, charcoal one pound four ounces.

These charges are bored a little with a round bodkin.

Meal powder two pound, sea coal eight ounces, and charcoal ten ounces.

Meal powder three pound, brimstone eight ounces, and charcoal ten ounces.

These charges may be used for triple wheels, and must be bored one third with a bodkin.

*For Wheels of one Pound Rockets.*

**M**EAL powder six pound, saltpetre three pound, brimstone one pound seven ounces, charcoal two pound nine ounces, and tanners dust one ounce.

The bore must be an inch and an half.

*For*

*For Wheels of one and a half, and two Pound Rockets.*

**M**EAL powder six pound, saltpetre three pound and a half, brimstone one pound and a half, charcoal two pound three quarters, and saw dust one ounce and a half.

The first rocket in the wheel is in length two diameters and a half of its orifice.

*For Wheels of three and four Pound Rockets.*

**M**EAL powder nine pound, saltpetre one pound and a half, brimstone one pound two ounces, and charcoal three pound four ounces.

The first rocket is bored but one and a half of its diameter.

To make single and double CARTOUCHES OF BOXES, TUBES, STARS, SPARKS, &c.

**W**HEN some hundred boxes or cartouches, are adjusted and fixed in machines of great fire-works, they afford among the trowing rockets great delight to the spectators. These boxes are made either of wood, paste-board, or copper; and are charged and proportioned according to their strength, with the charge and composition that is designed for them. If made of wood they must fit exactly, and receive each other, so as to seem but one continual piece; and if paste-board, you must glue on a foot at bottom, of a hand high, to each of them: the inside of these machines must exactly fit and correspond with the outside of the cartouches themselves, and be so contrived as to slip into one another.

The engine, Fig. 42. is very proper for the construction of those boxes, the latter represents the bench, and B the cylinders, upon which, (having greased them first over with soap,) you fashion your boxes, just as you think proper, by pasting one thickness of paper upon another, and fixing a handle to the end of the cylinder.



Having formed them, put them to dry in a moderate heat, too great a heat will shrivel them up; when dry, take one after another off the cylinder, and immediately clap round wooden bottoms, the edges being first done over with glue, into them, and sprig them on the outside to make them secure.

The single boxes are to be charged in the following manner:

1. Put in some corn powder.
2. Upon that charge fix a round paste-board, well fitted to the concave side of the box, which has five or six small holes, and is on both sides laid over with meal-powder tempered with brandy.
3. Put upon the paste-board a little meal powder, and upon that well pierced crackers, so as to stand with their necks downwards: the principal rocket is put in the middle, with the neck downwards open at both ends, so that being lighted above and burning down it may fire the rest of the crackers, which are blown up in the air by the corn powder.
4. The empty spaces between the large fire case and the crackers are carefully filled up, and the cartouch is stuffed at top with tow, or else boiled in saltpetre lee, with saw-dust.
5. The cartouch is covered with a cap, which is glewed very closely thereon, and for the great case reaching out of the cartouch; make in the middle of the cap a hole, through which it is put, and close the opening by glewing some slips of paper round it. The fire-case is loose, covered with a paste-board cap.

*Double Boxes or Cartouches.*

**I**N Fig. 43 is exhibited the construction of a case, called a double one; to enlarge on the description thereof seems

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to be needless, only observe, that the bottoms of the upper boxes, serve for the covers of the lower, a hole being made, through which the composition of the lower box is fired, after the upper rocket has forced away the empty box, which already has discharged its load. The upper box you cover as has been shewn above. If there are more than two cartouches upon one another, they are called Burning Tubes, which when fired shorten by degrees, the cartouches following one another till all are fired; some are intermixed with artificial globes, and several other fancies, which afford great pleasure to the spectators.

These boxes or cartouches are placed in long cases made for that purpose. The vacancies about the cartouches may be filled up with sand. See Fig. 44.

*Another Sort of Fire Tubes*

**A**RE made of solid, hard and dry wood, of what height and thickness you think proper, bore the middle of the wood one third or a quarter of its diameter, after which divide the whole height into equal parts, each exactly corresponding with the sky rockets you design to fix upon them, but rather a small matter shorter; all these divisions are cut sloping downwards, except the uppermost, which must run out in a cylinder. On the rims of each of these divisions make a groove all round, of about a fingers breadth; in these grooves bore small holes, by which the fire may be conveyed through pipes from the cavity of the tube, to light the rockets that stand behind the paper cartouches, which must be made secure to the wood, lest they should fly up along with the rockets.

The construction of the hollow tube in this and other such like tubes is expressed in Fig. 45. A the fire stars and sparks, interspersed with corn powder. B a box filled with paper or crackers. C a fire-ball or water-globe, which of them you please. D another box filled with crackers. The hollows between these fires are filled up with corn-powder, to blow up the globes and boxes one after another.

The stars and sparks made use of on this occasion are prepared in the following manner :

Take

Take of beaten saltpetre five pound and a half, meal powder two pound four ounces, and brimstone one pound twelve ounces.

Meal powder three pound, saltpetre six pound, brimstone one pound, camphir half an ounce, tanners bark two ounces, or else saw dust; all finely sifted and moisten'd with linseed oil.

Meal powder one pound, saltpetre four pound, brimstone half a pound, and pounded glass six ounces, moistened with linseed oil.

Saltpetre half a pound, brimstone two ounces, antimony one ounce, and meal powder three ounces.

Saltpetre half a pound, brimstone three ounces, antimony one ounce, and iron file-dust half an ounce.

Saltpetre two pound, meal powder ten pound, and brimstone one pound.

Saltpetre one pound, brimstone half a pound, meal powder three ounces, and antimony one ounce.

Saltpetre one pound, sulphur two ounces, powder of yellow amber one ounce, crude antimony one ounce, meal-powder three ounces.

Sulphur two ounces and a half, saltpetre six ounces, fine meal-powder five ounces; frankincense in drops, mastick, mercury-sublimate, of each four ounces; white amber and camphir of each one ounce, antimony and orpiment of each half an ounce.

These ingredients being well beaten, and searced thro' a scarcer, must be sprinkled over with a little glew or gum water, and form'd into little balls, of the bigness of a small nut, then dry'd in the sun, or near a fire, and lay'd up in a dry place, to be ready, on occasion, for playing off with fire-works. When you use them, wrap them up in tow.

*The following Stars are of a more yellowish Cast, inclining to White.*

**T**AKE four ounces of gum-tragacant, or gum-arabick pounded and sifted through a fine sieve, camphir dissolved in brandy two ounces, saltpetre one pound, sulphur half

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*To the LABORATORY, &c.*      lix

half a pound, coarse powder of glass four ounces, white amber one ounce and a half, orpiment two ounces; incorporate them, and make balls of them, as directed before.

*Sparks are prepared thus.*

**T**AKE saltpetre one ounce, ditto melted half an ounce, meal-powder half an ounce, and camphir two ounces; having melted these things by themselves, (when you use them) put them together in an earthen pot, pour on them water of gum tragacant, or brandy that has had gum-arabick, or gum tragacant dissolv'd in it; that the whole may have the consistence of a pretty thick liquid; this done take one ounce of lint, which before has been boil'd in brandy, vinegar, or saltpetre; when dry, throw it into the composition, mix and stir it about, till it has soak'd it up; then roll them up in pills about the bigness of great pins-heads, and set them to dry, having first sprinkled them with meal-powder.

Some of these pyramidical tubes and fire-works, are now and then fired in large rooms, upon grand entertainments in miniature, wherein are employ'd odoriferous pills, and other ingredients, that have a fragrant smell; these pills are commonly composed of *Storax Calamita*, benjamin, gum-juniper, of each two ounces; *Olibanum*, mastick, frankincense, white-amber, yellow amber, and camphir, of each one ounce; saltpetre three ounces; lime-tree-coal four ounces; beat these ingredients very fine, pulverize and incorporate them together; and moisten it with rose-water, wherein before you have dissolv'd some gum-arabick or gum-tragacant, you may form them into pills, and dry them in the sun or before a fire.

*Single Tubes or Cases*

**A**RE only filled with compositions, and to the outside are fastened some crackers, serpents, or cartouches; these cases being generally round and uniform, like a cylinder, you are to trace out a winding line from the top to the bottom, on which cut holes to the depth of two or three inches, See Fig. 46. B and C. Into these holes contrive to fix paper cases



Take of beaten saltpetre five pound and a half, meal powder two pound four ounces, and brimstone one pound twelve ounces.

Meal powder three pound, saltpetre six pound, brimstone one pound, camphir half an ounce, tanners bark two ounces, or else saw dust; all finely sifted and moisten'd with linseed oil.

Meal powder one pound, saltpetre four pound, brimstone half a pound, and pounded glass six ounces, moistened with linseed oil.

Saltpetre half a pound, brimstone two ounces, antimony one ounce, and meal powder three ounces.

Saltpetre half a pound, brimstone three ounces, antimony one ounce, and iron file-dust half an ounce.

Saltpetre two pound, meal powder ten pound, and brimstone one pound.

Saltpetre one pound, brimstone half a pound, meal powder three ounces, and antimony one ounce.

Saltpetre one pound, sulphur two ounces, powder of yellow amber one ounce, crude antimony one ounce, meal-powder three ounces.

Sulphur two ounces and a half, saltpetre six ounces, fine meal-powder five ounces; frankincense in drops, mastick, mercury-sublimate, of each four ounces; white amber and camphir of each one ounce, antimony and orpiment of each half an ounce.

These ingredients being well beaten, and searced thro' a searcer, must be sprinkled over with a little glew or gum water, and form'd into little balls, of the bigness of a small nut, then dry'd in the sun, or near a fire, and lay'd up in a dry place, to be ready, on occasion, for playing off with fire-works. When you use them, wrap them up in tow.

*The following Stars are of a more yellowish Cast, inclining to White.*

**T**AKE four ounces of gum-tragacant, or gum-arabick pounded and sifted through a fine sieve, camphir dissolved in brandy two ounces, saltpetre one pound, sulphur half

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half a pound, coarse powder of glass four ounces, white amber one ounce and a half, orpiment two ounces; incorporate them, and make balls of them, as directed before.

*Sparks are prepared thus.*

**T**AKE saltpetre one ounce, ditto melted half an ounce, meal-powder half an ounce, and camphir two ounces; having melted these things by themselves, (when you use them) put them together in an earthen pot, pour on them water of gum tragacant, or brandy that has had gum-arabick, or gum tragacant dissolv'd in it; that the whole may have the consistence of a pretty thick liquid; this done take one ounce of lint, which before has been boil'd in brandy, vinegar, or saltpetre; when dry, throw it into the composition, mix and stir it about, till it has soak'd it up; then roll them up in pills about the bigness of great pins-heads, and set them to dry, having first sprinkled them with meal-powder.

Some of these pyramidical tubes and fire-works, are now and then fired in large rooms, upon grand entertainments in miniature, wherein are employ'd odoriferous pills, and other ingredients, that have a fragrant smell; these pills are commonly composed of *Storax Calamita*, benjamin, gum-juniper, of each two ounces; *Olibanum*, mastick, frankincense, white-amber, yellow amber, and camphir, of each one ounce; saltpetre three ounces; lime-tree-coal four ounces; beat these ingredients very fine, pulverize and incorporate them together; and moisten it with rose-water, wherein before you have dissolv'd some gum-arabick or gum-tragacant, you may form them into pills, and dry them in the sun or before a fire.

*Single Tubes or Cases*

**A**RE only filled with compositions, and to the outside are fastened some crackers, serpents, or cartouches; these cases being generally round and uniform, like a cylinder, you are to trace out a winding line from the top to the bottom, on which cut holes to the depth of two or three inches, See Fig. 46. B and C. Into these holes contrive to fix paper cases

cases with wooden bottoms, wherein you may put any sort of rockets you please, as you see in A and E; but take care you provide little holes, to lead from the great tube to the corn powder under your rockets.

Another fire-tube is delineated Fig. 47. This is surrounded with cartouches, disposed in a serpentine order, like the first, which are glewed and nailed as secure as possible; out of these are dispersed great numbers of squibs; as for the rest, they have nothing but what is common in others.

*Another Fire Tube.*

THE circumference of this cylinder is by a cord divided into a certain number of equal parts, and being brought into a polygonal figure, by cutting away the convex parts it is brought into angles.

Then bore the plain sides with a number of holes perpendicular, so as to penetrate obliquely to the great boring in the middle: into these holes thrust crackers, squibs, or serpents. See Fig. 48.

Fig. 49 exhibits a tube, whose length is six diameters of its thickness. The cylinder being divided round the rim into six parts, then subdividing each of those into seven parts, reserve one of them for the list, between each of which make channels, which being six in number, place little mortars of the same dimensions therein.

The mortars must be turned of wood; bore the bottoms and add a chamber to them, as you see at E, each chamber must be one third or one half of the depth of the fluting, and the breadth one sixth only. These chambers are designed to hold corn powder.

Secure those mortars on the outside with strong paper cases, and nail them fast in the hollow channels, whose cavity they are to fit exactly; their length may be doubled to their breadth; each mortar must contain a globe made of paper, with a wooden bottom, and their chambers must be charged with corn powder.

These mortars fix in a spiral line, one only in each fluting, with iron stays, and bind the middle with an iron plate, fastened

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tened on each side of the interstices; but before you fix the mortars, you must not forget to pierce little holes in the tube, and to fix the touch-holes of your mortars exactly upon them, priming both with meal powder. Every thing relating to this may be plainly conceived in the figure, where A and B describes the mortars, and C the globe or cartouch.

*Of Salvo's.*

**T**HESE, in fire-works, are a great number of strong iron reports fixed either in a post or plank, and with a fire discharged at once.

*Charges for Cartouches or Boxes.*

**M**EAL powder six ounces, saltpetre one pound eight ounces, brimstone four ounces, and charcoal four ounces and a half.

Meal powder fourteen ounces, saltpetre five ounces, brimstone two ounces, and charcoal three ounces.

Meal powder one pound, saltpetre three quarters of a pound, brimstone four ounces and a half, tanners bark or saw-dust two ounces, and charcoal four ounces.

*Charges for Fire Tubes.*

**M**EAL powder six pound, saltpetre four pound, charcoal two pound, rosin half a pound, tanners bark five ounces, moistened with a little linseed oil.

Meal powder three quarters of a pound, saltpetre four pound, brimstone ten ounces, and saw-dust four ounces. This charge may be used dry.

Meal powder five pound, saltpetre three pound, charcoal one pound six ounces, rosin three quarters of a pound; not moistened.

*A Preservative for Wood against Fire.*

**T**HIS being a necessary article in the execution of fire-works, it will not be improper to set it down in this place.

Take



Take brick-dust, ashes, and iron-filings, of each an equal quantity; put them together in a pot, pour glew water or size upon it, then put it near the fire, and when warm stir it together. With this size wash over your wood-work, and when dry repeat it, and it will be proof against fire.

*The Manner of preparing and making Letters and Names in Fire-Works.*

**B**URNING letters may be represented after several methods.

Order a joiner to cut capital letters, of what length and breadth you please, or about two foot long and three or four inches wide, and an inch and a half thick; hollow out of the body of the letters, a groove, a quarter of an inch deep, reserving for the edges of the letters a quarter or half an inch of wood. If you design to have the letters burn of a blue fire, then make wicks of cotton or flax, according to the bigness and depth of the grooves in the letters, and draw them leisurely through melted brimstone, and place them in the grooves; brush them over with brandy, strew meal powder thereon, and again with brandy and thin dissolved gum tragacant, and on that strew meal powder again; when dry drive small tacks all round the edges of the grooves, and twist small wire to those tacks, that it may cross the letters and keep the cotton or flax close therein; then lay over it brandy paste; strew over that meal-powder, and at last glue over it a single paper.

If you would have the letters burn white, dissolve six pound of saltpetre, and add to it a little corn-powder; in that dip your wicks of cotton or flax. You may instead thereof use dry touch-wood, which cut into pieces of an inch thick; put them in melted saltpetre over a fire, let them lay therein till the saltpetre is quite soaked thro' the wood, after which mix powdered saltpetre with good strong brandy; take some cotton, and with a spatula or your hands, work that, the saltpetre and brandy, together; then squeeze it out, strew the cotton over with powder'd saltpetre, and thereof make wicks, having placed first the touch-wood in the

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the grooves, lay the wicks over that and the vacancies about it, and then proceed to make it tight and secure, as has been directed above. See Fig. 40.

There is another method for burning letters without grooves, and this is done by boring small holes in the letters, of about an inch distance, one from the other; the diameter of those holes must not be above the eighth of an inch; into them put and glew cases, ram'd with burning charges; but these letters do not burn so long as the others, except the charges are very long.

Another method for burning of letters is used, when they are form'd by a smith of coarse wire, about a quarter of an inch thick; when this is done get some cotton spun into match-thread, but not much twisted, to two yards of this take one pound of brimstone, six ounces of saltpetre, and two ounces of antimony; melt these ingredients in a kettle, first the brimstone by itself, and then the rest all together; when melted, put in the match-thread; and stir it about, till it has drawn in all the matter; then take it out, and strew it over with meal-powder, let it dry, and wind it about the white letters; fasten these upon a board, that has been well laid over with a preservative to keep it from firing. When you have lighted one letter, all the rest will take fire immediately.

Letters cut in a smooth board, which is made to slide in grooves of a chest are ordered thus: The lid of the box is made full of holes for dispersing the smoak of the lamps, or wax-tapers, which are set behind, to illuminate the letters, behind the cutout letters is pasted oil paper of various colours, which, when the lamps are lighted, has a fine effect. By these means, various changes may be made, in representing devices, names, coats of arms, &c. But this way is more practised on the stage in plays than in fire-works.

*Charges for Burning Letters with Cases.*

**M**EAL-powder six ounces, saltpetre one pound, mix'd with *Porrolio* oil.

Meal-powder three quarters of a pound, saltpetre nine ounces, and brimstone three ounces, mix'd up dry.

Meal

Meal-powder five ounces, saltpetre seven ounces, brimstone three ounces, and file-dust half an ounce; moistened with linseed oil.

*To order and preserve Leading-fires, Trains, and Quick-matches.*

**F**IRE-works being of various kinds and inventions, it is impossible to assign certain rules for their several performances. But to say something of what concerns a master's praise, it is to be observed, that great fire-works are not to be fired above once or twice at most; for it would not be deemed an artful performance, to fire one cartouch after another; likewise the match-pipes, the most preferable of which are either iron, lead, or wood, and should be strengthened or closely twisted round with the sinews of beasts, steeped in dissolved *Feather-white* and filled with slow charges, which ought to be well tried. Or else furnished with match-thread of *Stupinen*, dry and well prepared, and afterwards either joined to the grooves made in the boards, or only laid free from one work to another. The joinings of the pipes must be well closed and luted with potter's clay, so as to prevent the fire from breaking out; these pipes must also have little vent holes to give the fire air, or else it would be stifled, or burst the pipes; but these holes must be so contrived, that the flame may vent itself in the open air, and at some distance from the works, so as to prevent touching them.

All burning matches are to be as distant from the machines as possible, to prevent accidents.

A particular direction for conducting your trains and fuzes, cannot be given, because of the variety of postures, situations and contrivances of machinery; those rules already given will be sufficient for the ingenious; add to this the advantage a novice in this art, may gather from the sufficient direction in this matter from the figures, which, with much care and industry, have been traced out for their information and benefit.

*Charges*

*Charges for Fuzees or Leading-matches.*

**M**EAL-powder three ounces and a half, saltpetre four ounces, brimstone one ounce and three quarters, and charcoal one ounce and three quarters.

Meal-powder three ounces, saltpetre nine ounces, brimstone four ounces and a half, and charcoal half an ounce.

Meal-powder four ounces, charcoal half an ounce, and coarse coal half an ounce.

Meal-powder half a part, saltpetre three parts, brimstone two parts, and charcoal one part: this last is very slow.

*Of Water-balls.*

**B**ALLS, in fire-works, are made of different fashions, some are globular, some oval, some conical, some cylindrical, and others in the form of a pendant or drop.

The water-balls are commonly made of knitted cord-bags, or of wood, those made of bags are shaped like ostriches eggs, and are

1. Fill'd with their proper charge.
2. The outside is dip'd in glew, and wound about with hemp or flax, till it is a quarter of an inch thick thereon.
3. This ball is then coated over with cloth, and about the touch-hole is glewed over with a piece of leather.
4. The touch-hole is bored with a gimlet, and stop'd with a wooden peg.
5. At the bottom of the globe pierce a small hole thro' to the composition, in which fasten a small copper-pipe, furnished with a paper report, together with a leaden balance; glew the report fast to the ball, then dip the ball in melted pitch, open the touch-hole, and prime it with a quick burning charge.

These balls keep a long time under water, before they rise, and if a true balance is not observed in the lead, or the ball is overcharg'd, they will sink to the bottom and burn out, therefore you must well observe, that when a water-ball without the ballance is two pound weight, you must give it four or four ounces and a half of lead, but if it weighs one



pound and a half, balance it with three or three ounces and a half.

Water-balls or globes made of wood, which swim and burn upon the water without any further effect, are of two sorts, *viz.* single and double, the single ones are made thus: have a hollow globe turn'd somewhat oblong, with a vent-hole, fill that with a good and approv'd charge, but not too close, prime the end with some meal-powder, then glew a stopple in the hole, which must be thrice as thick, as the shell of the globe, in which beforehand the counterpoise is cast of lead; when dry, make a hole at top, large enough for a two ounce cracker to enter, through this ram down the charge in the globe, and fill it quite full with the same composition; then glew it over with a paste-board: and lastly fix a small copper-pipe through the stopple, having bored a hole through it for that purpose; to the pipe fasten a paper report; when this is done dip the whole in pitch: these are call'd single water-globes. Both sorts of globes are, for the better security, twisted and tied round with several rows of strong packthread.

Double water-globes are such which after one is fired, discharges another. These have chambers at bottom which are fill'd with gun-powder; on these put a cover of thick leather, which has several holes in the middle, and goes close to the sides; on this strew meal-powder, and placethereon a fire-globe, which is charged. Fig. 52. will demonstrate the construction with more ease than a long lesson; observe,

1. That the little chamber at bottom ought to be the fifth of the breadth of the whole globe, and that its height be one and a half thereof.

2. That the water-ball B, should be encompass'd with a water-ball composition, as you see by H.

3. The partition C is for this purpose, that when the powder in it shall have the fire conveyed to it through the pipes E F G, it may with more force blow up the ball, in the body of the first; this taking fire at the hole D, will burn upon the water for some time, and then, to the astonishment of the spectators, on a sudden, it will blow up the ball that was in it.

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4. You must be very careful to secure the piece of leather or board that covers the little chamber, least it should be blown up by the composition of the greater globe, before it is all burn'd out.

*How to charge a Water-globe with many Crackers.*

**T**AKE, for this purpose, a single water-globe, which may be round or of an oval form, fill the same with the composition hereafter mentioned. Hollow the outside thereof in several places, to the size of your reports or crackers, which are to be fix'd in them; to each of the crackers belongs a small copper tube, fill'd with meal-powder, which are to be fitted to the small holes in the flutings, in the manner as expressed in the print, where Fig. 53. A are the flutings, B the little holes for the fuzees, C the upper orifice for priming, D the hollow stopple, through which the ball is primed, E the form of the crackers, which are to be fix'd in the flutings, F little fuzees belonging to them.

*How to prepare a Water-mortar, or Water-pump with several Tubes.*

**T**AKE seven wooden tubes, wrap them about with cloth that is either pitch'd or dipp'd in glue, twisting them round very tight with packthread. Their height, thickness and diameter you may order as you think proper, only allowing the middlemost a greater height than the rest; bind them together in one cylindrical body; to the bottom fix a round board with nails, and then with strong glew stop up all the crevices to prevent the air getting to the composition: this done fill the tubes according to the order represented in Fig. 54. First pour into each tube, a little corn-powder, about half an inch high; upon that put a water-ball A, upon that a slow composition; then again corn-powder; upon which put a water-globe fill'd with squibs, as you see in B, on that again a slow composition, then corn-powder, and then a light ball, as may be seen in C, over this put a third time a slow composition on corn-powder, as before, which you must cover with a wooden cap: on this fix running rockets, not too close, but to leave room enough

between for a wooden case fill'd with a water composition; the remainder of the tube fill with a slow charge; and close it up. Your tubes being all fill'd in this manner, get a square or round piece of plank, with a round hole in the middle, large enough to receive the ends of all the tubes, which cover close, to preserve the powder and composition from being wet, this float-board is mark'd with the letter D, Fig. 55. Thus prepared, dip it in a quantity of tar, or melted pitch, then put the rocket E, or a small wooden tube fill'd with a strong composition that will burn on the water into the orifice of the middle tube; the composition of which should be more slow than of the rest.

If you would have the tubes take fire all round at once, you must pierce the sides of the great one with small holes, corresponding with those in each of the other tubes; by this means the fire may be convey'd to all of them at once, and consume them equally and at the same time; but if you would have them burn one after another, you must close them well up with pasteboard, and to each tube fix a fuzee of communication, fill'd with meal-powder or a slow composition, thro' which the fire may be convey'd from the bottom of that which is consumed, to the orifice of that next to it, and so on successively to such as have not been fired.

*How to Charge a large Water-globe, with several little ones, and with Crackers.*

**H**A V E a wooden cylinder made, let the orifice thereof be at least one foot diameter, and its height one and a half; let there be a lodge or chamber at bottom to hold the powder, which must be confin'd therein, by a rampion or stopple joined to a round board, fitted exactly to the inside of the globe, through the middle of the stopple must pass an iron tube fill'd with meal-powder; then prepare six water-balls, or more if you think fit, so that when all are set together in the circumference of the globe, they may fill up that circle; each of these balls must be provided with an iron-fuzee in its orifice, fill'd with meal powder. Having charged the chamber of the globe with corn-powder, let down the forementioned board with the stopple upon it, then range the six water-balls, cover them with another round board,

board that has six little round holes, corresponding with the six iron fuzes of the balls, and which must a little surmount it. This last board spread over with meal and corn-powder mix'd together, and upon it you place as many rockets as the globe can hold: in the midst of these you fix a large rocket, into whose orifice the iron tube may enter, which is the same you see in E, Fig. 56.

This tube must have holes drill'd all round the plane of the 'foresaid partition or board, to the end that the fire having a communication through them, it may reach the running rockets, and at the same time fire the water-balls, whose tubes rise out of the board, and from thence, after having penetrated down to the chamber below, it may blow up the whole into the air, and make a great noise. See the figure, where A points out the six water-balls, B the great rocket in the middle of the running ones, C the chamber for the powder, D a communication, or the iron pipe, to convey the fire to the paper cracker, F the globe, which having adjusted after the manner directed, cover it close round, dip it in tar, to preserve it from the water.

*To prepare the Water Bee-hive or Bee-swarm, both single and double.*

**T**HE single bee-swarm is thus prepared. Have an oblong globe turn'd, whose length is two diameters of its breadth, or proportioned to the height of your rounding rockets, which place round the wooden tube marked with A; this must be of an equal height with the globe, and be fill'd with a composition of three parts of powder, two of saltpetre and one of brimstone; at the lower end of the globe fix a paper cracker C; the letter D is a counterpoise of lead, through which you convey a little pipe or fuzee, to communicate with the charge in the wooden tube; at top fix a round board for a balance; F two little holes which convey the fire to the charge for blowing up the rockets. See Fig. 57.



*How to prepare a Water-globe on the outside with Running-Rockets.*

**G**ET a wooden globe perfectly round and hollow, bore on the outside several cavities, sufficient to receive running-rockets, leaving a quarter of an inch between the extremities of them, and the composition within the ball; then bore the wood, left between each, with a small gimlet, fill them with meal-powder, then put in your rockets; close the top of the globe with a wooden cylinder, that has a hollow top, with a touch-hole to receive the priming, the bottom stop with a stopple, which likewise has a conveyance to the cracker that is commonly fix'd beneath it; between which and the stopple fix also a leaden counterpoise, to keep the whole upright in the water. See Fig. 58.

*To prepare Water-globes with single or double ascending Rockets.*

**F**OR the first sort have a globe turn'd with a tube in the middle, half its diameter wide; leaving two inches for the placing of solid wood at bottom; round this tube bore holes for small rockets thereon, after which you burn, with a red hot wire or small iron, touch-holes, out of the large tubes, into the little ones, then fill the globe with the following composition, viz.

Two pound of saltpetre, eight ounces of brimstone, eight ounces of meal-powder, twelve ounces of saw-dust; this done close the top with a stopple, which has a touch-hole in the middle, then put a good deal of meal-powder in the small tubes, up to the touch-holes; and after you have plac'd your rockets upon that, fill the vacancy round with a little corn-powder, glew over them paper caps, then dip the globe into pitch, but not over the paper covering; fix a counterpoise at bottom; and when the fire has burn'd half way or further, in the large tube, it will communicate through the touch-holes, and discharge all the rockets at once.

The second sort is done after the same manner, only the middle tube is not bored so wide, because of giving more room

room for two rows of small tubes round it; the first row next to the tube is bored a little below the middle, the second almost near to the end thereof; the touch-holes for the former are burnt from the inside of the great tube, and those of the latter from the outside hole are closed again with a wooden pin: in the large tube you may lodge a strong report of iron, charg'd with corn-powder, having a touch-hole left at top. See Fig. 59, 60.

*Charges for single Water-globes.*

**C**ORN-powder half a pound, saltpetre sixteen pound, brimstone four pound, ivory shavings four ounces, saw-dust boil'd in saltpetre lee four pound.

Meal-powder one pound, saltpetre six pound, brimstone three pound, iron-filings two pound, and rosin half a pound.

Meal-powder four pound, saltpetre twenty-four pound, brimstone twelve pound, saw-dust eight pound, powdered glass half a pound, and camphir half a pound.

Corn-powder one ounce, saltpetre twelve ounces, brimstone four ounces, and saw-dust three ounces.

Saltpetre twelve ounces, brimstone four ounces, saw-dust two ounces, melted stuff three quarters; this must be ram'd in tight.

Meal-powder one pound four ounces, saltpetre one pound eight ounces, brimstone nine ounces, saw-dust five ounces, pounded glass one ounce, melted stuff four ounces; mix them together with a little linseed oil.

Meal-powder eight ounces, saltpetre five pound, brimstone two pound, copper filings eight ounces and a half, and coarse coal-dust eight ounces and a half.

Saltpetre eight ounces, brimstone three ounces, saw-dust one ounce, and tanners-bark two ounces.

Saltpetre six pound twelve ounces, brimstone two pound fourteen ounces, melted stuff half a pound, saw-dust one pound, coarse coal-dust one pound, and pounded glass one pound, mix'd up and moisten'd with vinegar.

Saltpetre two pound twelve ounces, brimstone two pound six ounces, melted stuff four ounces, saw-dust eight ounces, charcoal one ounce and a half, and pounded glass three

quarters of an ounce, moisten'd with linseed oil, and mix'd up with a little corn-powder.

*Charges for double Water-globes.*

**S**altpetre four pound six ounces, brimstone one pound four ounces, saw-dust half a pound, and coarse-coal dust six ounces, moistened with a little vinegar or linseed oil.

Meal-powder one pound four ounces, brimstone four ounces, and charcoal two ounces, moistened with *Petroleum* oil.

Saltpetre three pound, brimstone a quarters of a pound, and saw-dust boiled in saltpetre ten ounces, moistened a little.

*Charges for Bee-swarms.*

**M**EAL-powder thirteen ounces and a half, saltpetre six ounces, brimstone two ounces and a half, fine charcoal three ounces, coarse charcoal one ounce, and fine saw-dust three ounces.

Meal-powder three quarters of a pound, saltpetre six ounces, brimstone three ounces and a half, fine charcoal four ounces, and coarse charcoal two ounces and a half.

Meal-powder four parts, saltpetre eight parts, brimstone two parts, coarse charcoal two parts, and fine charcoal one part.

*Odoriferous or perfumed Water-balls.*

**H**AVE balls turned about the size of large walnuts, fill them with any of the compositions specified below; after they are filled and ready, light and put them into water. This is generally done in a large room or hall, at grand entertainments.

*The Compositions for them are as follows:*

**S**altpetre four ounces, *Storax Calamita*, one ounce, frankincense one ounce, mastic one ounce, amber half an ounce, civet half an ounce, saw-dust of juniper two ounces, saw-dust of cypress two ounces, and oil of spike one ounce.

Salt-

Saltpetre two ounces, flower of sulphur one ounce, camphir half an ounce, raspings of yellow amber half an ounce, coal of lime-tree wood one ounce, flower of benjamin, or *Assa odorata* half an ounce; let those which are to be powdered, be done very fine; then mix them together as usual.

Saltpetre two ounces, myrrh four ounces, frankincense three ounces, amber three ounces, mastic one ounce, camphir half an ounce, rosin one ounce, boiled saw-dust one ounce, lime-tree coals half an ounce, bees-wax half an ounce; mix them up with a little oil of juniper.

Saltpetre one ounce, myrrh four ounces, frankincense two ounces and a half, amber two ounces, mother of pearl four ounces, melted stuff half an ounce, and rosin half an ounce; mix them up with oil of roses.

Meal-powder three ounces saltpetre twelve ounces, frankincense one ounce, myrrh half an ounce, and charcoal three ounces, mix'd with oil of spike.

*The Manner of preparing the Melted Stuff.*

**M**ELT twenty four pound of sulphur in a shallow earthen pan, over a clear fire, and as it melts sling in sixteen pound of saltpetre; stir them well together with an iron spatula; as soon as they are melted take it off the fire, and add to it eight pound of corn-powder; mix it well together, and being cooled, pour out this composition upon a polished marble, or metal-plates, and then divide it into pieces about the size of a walnut. This composition is chiefly used in military fire-works, and not for those I am treating of; but for those fire-works which are only for pleasure: it is distinguish'd by warm and cold melted stuff, and is prepared in the following manner:

Take for the first sort half a pound of saltpetre, grind among it three quarters of an ounce of antimony, till one cannot be distinguished from the other; then melt one pound and a half of brimstone, put the mix'd saltpetre and antimony to it, and mix them well together; this done put it warm into a wooden mould of two pieces, which should be well greased on the inside: this stuff you break afterwards in bigger or lesser pieces; it is, on account of its clear fire, used to imitate stars.

The



*The Manner of preparing the cold melted Stuff.*

**G**RIND the above ingredients, or eight ounces of meal powder, four ounces of saltpetre, three ounces of brimstone, and one ounce of coal-dust, together, till all is of one colour; this done, moisten that stuff with the white of eggs, gum-water, or sice, and make thereof a stiff dough; then strew on a smooth board some meal powder, roll the dough upon that a quarter of an inch thick, strew again meal powder upon it, then cut it in square pieces, and let them dry; or else form small balls of it, of the size of a small nut or larger; then roll them in meal-powder and put them up to dry.

*To prepare a Globe which burns like a Star, and leaps about both on Land and Water.*

**C**AUSE a globe to be turned of dry wood, whose diameter is the length of a half pound or a pound rocket: divide this globe into two equal parts, in the middle of one of the half globes, on the inside, make a cavity, deep, long and wide enough to hold three or four rockets or crackers, so that the other half of the globe may be easily and closely fitted upon them; after this take three crackers, one with strong reports and two without any, place them so into the hollow, that the head of the one may lay to the others neck, and be so ordered that as soon as the one is spent, the other may take fire and force the globe back, and thus alternately from one to the other till it comes to the report, which finishes. Care must be taken that the fire passes not from the first to the next cracker, before it has quite consumed the first; but as I have given a caution in the article about rockets that run on a cord, the same may be observed here.

Having taken care to fix the rockets, cover them with the other half globe, and join them firmly with strong pasted paper.

*To charge Globes, which leap on Land, with Iron and Paper Crackers.*

**T**AKE a hollow wooden globe, which has a touch-hole at the top, in the form of a small cylinder; fill it with an aquatic composition quite full; then bore into the

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*To the LABORATORY, &c.*      **lxxv**

charge five or six holes about half an inch wide, in which put iron petards or crackers, which run tapering; provide them at the lower end with a small touch-hole, and cover the top with a tin-plate, in which there is four holes, which you must close up with wads of paper or tow, after you have filled them with the best corn-powder; and when you fire them on even ground, you will see them leap as often as a cracker goes off. See fig. 61.

The other sort is not much unlike the first, except that to this you add a certain number of crackers, which are disposed as you may observe in Fig. 62. A the crackers, B the touch-hole.

*How the Globes discharg'd out of a Mortar, are made and ordered.*

**F**IRST find the mouth of the mortar, and divide it in twelve parts; then have a globe turn'd of wood, which is two diameters of the mouth high; divide the diameter in six equal parts, and let the height between A and C be the diameter of the globe, the radius of the semi-circle CI, shall be one sixth, or half the height of the globe, the thickness of the wood HI, shall be  $\frac{1}{2}$  of the above diameter, and the thickness of the cover of the diameter of the globe; the diameter of the cavity of the globe five sixths of its whole diameter; the height of the priming chamber BF shall be one sixth and a half of the diameter, but its breadth only one sixth; the diameter of the touch-hole is one fourth or one sixth of that of the chamber: for the better understanding these directions, see Fig. 63.

The manner of filling these globes is thus.

Take hollow canes or common reeds, cut them into lengths to fit the cavity of the globe, and fill them with a weak composition made of three parts of meal-powder, two of coal, and one of brimstone, moisten'd with a little linseed oil; excepting the lower ends of them which rest upon the bottom of the globe, which must have meal-powder only, moisten'd likewise with the same oil; or sprinkled over with brandy and dry'd: the bottom of the globe cover with meal-powder mix'd with an equal quantity of corn-powder; the reed  
being

being fill'd in this manner, set as many of them upright in the cavity of the globe, as it will contain; then cover it well at top; and wrap it up with a cloth dip'd in glue, the priming must be of the same composition with the reeds.

The globes represented; N<sup>o</sup> 97 and 98 are contrived like the above, only the first of these is fill'd with running rockets, and the last with crackers, stars, and sparks, interspersed with meal-powder; and put promiscuously over the crackers; the figures are so plain, that I need not give any further explanation.

N<sup>o</sup> 99 is the representation of a globe, which plainly shews its construction: the great globe which contains the lesser is the same as described above; for it is charged with running rockets; as that of 97. However with this difference, that this is lined but with single rockets, and the other is fill'd up with them. In the midst of these rockets fix a globe in a cylindrical form, with a flat bottom, and a chamber and touch-hole at A, the cavity of this inner globe is fill'd with iron crackers, and cover'd with a flat covering: the priming chamber fill with the same composition as has been directed for the above globes; the fuzees must be fill'd with good meal-powder.

N<sup>o</sup> 100 shews another sort of globe, which is prepared thus. First get a wooden globe, in the middle whereof fix a mortar with a little chamber for powder, round which form a lodge, for ranging paper tubes, this lodge must have a groove or channel, fill'd with meal-powder, to convey the fire all round; this done, put a globe into the mortar, fill'd with running rockets, crackers, reeds, or stars and sparks; and having placed your paper tubes fill'd with running rockets round the groove, cover them about with strong pasted paper and cloth, dipp'd in glue, as has been directed. The figure of this globe will illustrate the description, A shews the mortar, B the touch-hole, C the priming chamber, D the priming of the mortar, E in the other figure represents the order in which the paper tubes are placed upon the groove.

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*To form Letters, and all Sorts of Figures which may be represented in the open Air in a dark Night.*

**P**ROVIDE a wooden globe of the same form, height, breadth and thickness, as those already describ'd, only the priming chamber must be the height and breadth of one sixth of the diameter of the whole globe. Besides this chamber there must be another B, for corn-powder, the height and breadth must be equal  $\frac{1}{6}$  of the diameter of the globe, the vent-hole must be a quarter of the powder or priming chamber, you must also have another globe in a cylindrical form, the bottom of which must be rounded on the outside, as may be observed in the same figure by F, the cover must be let a little into the inner surface of the cover of the great globe, to keep it firm, placing this lesser globe perpendicularly over the chamber, which is fill'd with corn-powder.

Fill the cavity of the little globe with running rockets, stars and sparks, as may be seen in the figure at the bottom of the large globe; having furnished the vent-hole with meal and the chamber with corn-powder, put about the small globe the same composition, mix'd promiscuously together, and on this fit a flat wooden ring, very tight to the globe, in which bore holes, as you see in Fig. 101. Your globe being thus prepared, take two long thin slips of whale-bone, which bend easily without breaking; join them together parallel, so as to have their bendings opposite to each other, and make a straight piece; take two of these long pieces and join them as is seen in A by two shorter pieces at both ends, so as to make a right-angled parallelogram, RSTU; within this frame form your letters either of wire or whale-bone, placing each about a hands breadth from the other; and having fix'd your letters, wrap them neatly round in quick tow from one end to the other, taking care that none of it entangle about the frame, least when the letters burn, their flame should be confounded in one another; then steep your letters in brandy, wherein before you have dissolv'd some gum-arabick, and in drying strew them over with meal-powder; if you would have your letters descend perpendicular to the horizon, you must fasten

two



two small weights to your frame, at T and U, but if parallel to the plane of the horizon, you must have a weight at each corner; having order'd it thus, bend it round to go in the inner circumference of the great globe, and let it rest perpendicular on the wooden ring, and fill the empty places about the letters with meal powder; then cover it up, and prepare the globe fit for the mortar, as usual; it will have a delightful effect.

*To prepare the Quick Tow.*

**T**AKE either flax, hemp or cotton, of two or three strands, twist them slightly, and put them into a cleanglaz'd earthen pan, pour on them good white-wine-vinegar four parts, urine two parts, brandy one part, purified saltpetre one part, meal-powder one part, boil it all together over a quick fire, and till all the moisture is evaporated; then strew meal-powder on an even board, and roll your match therein, then let it dry either in the sun or shade. This sort of match burns and consumes very quick, but if you would have it burn slower, make the liquor weaker, boiling the match in saltpetre and vinegar only, and strewing meal-powder in it, let it dry.

Another sort of match is made by some which is not twisted at all, but only dip'd in brandy for some hours, then powdered over with meal-powder and dry'd; some dissolve a little gum-arabic or tragacant in the brandy, this will make it stick the better to any thing.

*To prepare the light Balls, proper to be used at Bonfires.*

**T**AKE two pound of crude-antimony, four pound of brimstone, four pound of rosin, and four pound of coal, and half a pound of pitch; having powdered all these ingredients, put them into a kettle or glaz'd earthen pan, over a coal fire, and let it melt; then throw as much hemp or flax into it as may be sufficient to soak it up; then take it off the fire, and whilst it is cooling, form it into balls.

You may wrap them up in tow, and put them either into rockets or globes.

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*To prepare the Paste for Stars and Sparks.*

**T**AKE five ounces and a half of meal-powder, one pound twelve ounces of brimstone. *Or,*

Take three pound of meal-powder, six pound of saltpetre, one pound of brimstone, two pound of camphir, and two ounces of tanner's bark or saw-dust. Moisten all these ingredients with linseed oil.

Take meal-powder one pound, saltpetre four pound, brimstone half a pound, and powder'd glass six ounces; moistened with a little linseed oil.

Saltpetre half a pound, brimstone two ounces, antimony one ounce, and meal-powder three ounces.

Saltpetre half a pound, brimstone three ounces, antimony one ounce, and iron file-dust half an ounce.

Saltpetre two pound, meal-powder ten pound, and brimstone one pound.

Saltpetre one pound, brimstone half a pound, meal-powder three ounces, and antimony one ounce.

Having mixed and prepared your ingredients, boil some flax in saltpetre lee and camphir, then cut it small and mix it up with any of the above compositions which must be moistened with either the white of eggs, gum, or sice: form this into little balls of the size of a hazel-nut, strew them over with meal-powder and let them dry.

To cause the stars to burn very bright, make your composition of one ounce and three quarters of saltpetre, three quarters of an ounce of brimstone, and a quarter of an ounce of powder.

Saltpetre two pound, brimstone fourteen pound and a half, and meal-powder six ounces.

The paste or melted stuff above mentioned, is also made use of for the same purpose, wrapt in tow.

*To project Globes from a Mortar, and the Quantity of Powder required for that Purpose.*

**T**HE globes being of wood, it is requisite that the charges for them should be agreeable to their substance, for which end they are first weighed, allowing for each

each pound of its weight a quarter of an ounce of gun-powder. For example, if your globe weighs forty pound, you must, to discharge it, allow ten ounces of powder.

The charge is thus performed: put the powder into the chamber of the mortar, and cover it with straw, hay, hemp or flax, so as to fill it quite full; or if the chamber of the mortar be too big, get one turned of wood equal in height and breadth to the chamber of the mortar, that contains the charge of powder required; pierce this with a red hot wire, from the bottom of the wood to the centre of the bottom of the chamber in it, not perpendicular but slanting, as from *c* to *b* in Fig. A. The place, where the touch-hole begins, must be mark'd, so that you may turn it to correspond with the touch-hole of the mortar. When you would load your mortar, cover the bottom of the chamber with a little meal and corn powder, mix'd together, and upon that put the wooden chamber, in which is the powder requir'd to discharge the globe; then fix the touch-hole of the globe exactly upon the chamber, wrapping it in hemp, &c. to make it stand upright.

The mortars contrived on purpose for globes are more commodious, and one is more certain in projecting them: these are cast as follows: the length of the mortar with the chamber, without the bottom, is two diameters of the mouth; the bottom is one fifth thick; the chamber is half the diameter of the mouth long, and a quarter wide, oval at bottom; the sides are an eighth of the diameter of the mouth thick, which is increased at bottom to a third; the thickness about the chamber is a fourth part.

Some prepare these balls with saltpetre four pound, brimstone one pound and a half, powder half a pound, antimony six ounces, and charcoal half an ounce.

Saltetre four pound, brimstone three pound, camphir a quarter of a pound, and powder half a pound.

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